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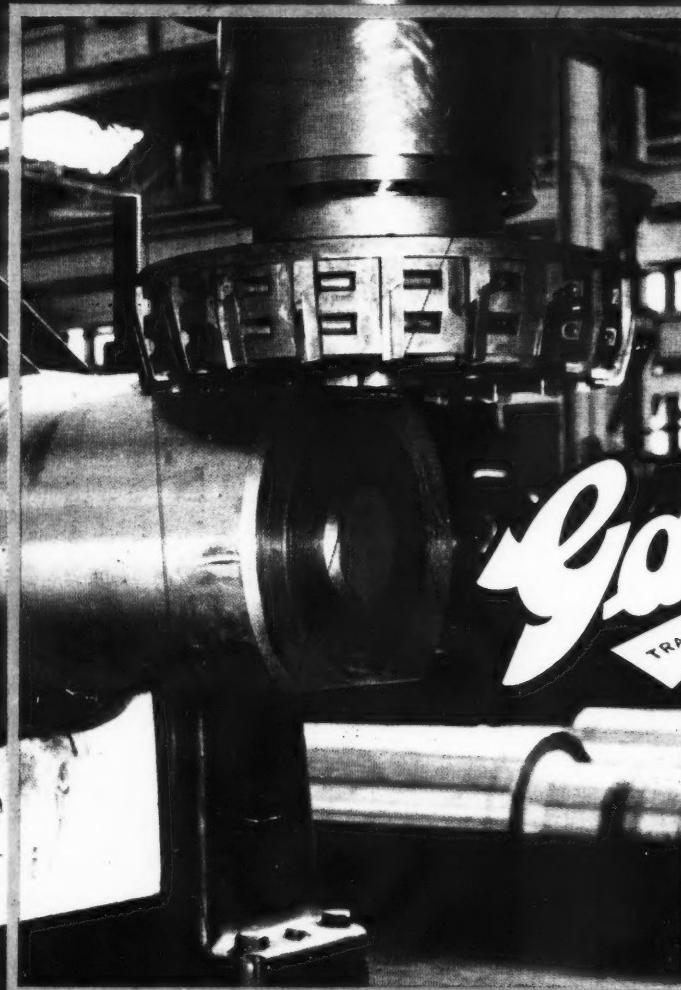
# MACHINERY

NOVEMBER 1, 1961

ONE SHILLING & THREEPENCE

TECHNOLOGY MANAGEMENT

SM



high  
performance  
on  
chilled  
Iron  
rolls

*Galtone*

TRADE MARK

## INSERTED BLADE CUTTERS

at Midland Rollmakers Ltd., Gresw...

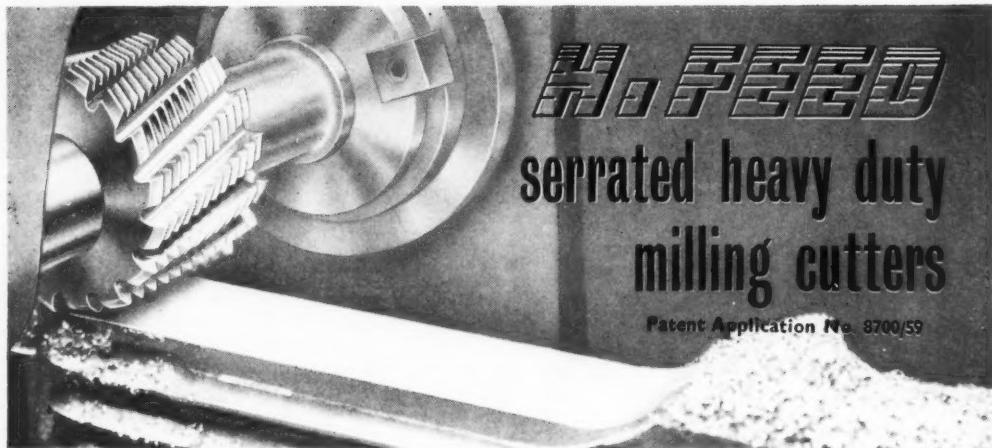
These "Galtone" Face Milling Cutters specially designed for milling the drive end of 'Manganite' strip mill rolls have proved particularly successful.

We specialise in standard and special milling cutters with plain or serrated inserted blades. Ask us to co-operate on your own milling problems.

RICHARD LLOYD LIMITED

GALTON HOUSE, ELMFIELD AVENUE, TYBURN, BIRMINGHAM, 24

Telephone: Ashfield 1801. Telegrams "Cogs. Birmingham"



# HiFEED

## serrated heavy duty milling cutters

Patent Application No. 8700/59

**BRAYSHAW**  
TOOLS LIMITED  
BELLE VUE WORKS,  
MANCHESTER 12.

Phone: EAs 1046 (3 Lines)

Grams: Hardening M/C.

HiFEED serrated heavy duty cutters are designed to provide a combination of high rate of stock removal and good surface finish.

Some of the advantages to be obtained are:-

**SINGLE POINT CUTTING EFFICIENCY.**

**REDUCED LOAD AND VIBRATION** on machine and work.

**INCREASED PRODUCTION**, particularly on work hardening

and high tensile materials.

**EFFICIENT HEAT DISSIPATION** resulting from the break up

of the cutting edges enables **HIGHER FEEDS AND SPEEDS**

to be employed.

Primarily designed for heavy stock removal HiFEED cutters produce a surface finish acceptable for most applications. An alternative design, offering similar advantages plus superior surface finish when required, is also available.

HiFEED cutters **INCREASE** production **REDUCE** costs.

Send to-day for your copy of leaflet S.T.603.

**£10,000**  
**STOCK OF BROACHES**  
*At your service*



CONSULT **H.A.P.**

The 'know-how' which has built the most comprehensive trade broaching and spalling service in the country.

**FIRST—THE GEAR SPECIALIST**

**INDLE UTO RODUCTS LTD** HAPCO WORKS CALEDONIA STREET BRADFORD 5  
Phone: BRADFORD 27234-5-6-7 Grams: HAPCO BRADFORD





November 1, 1961

MACHINERY



tipped  
CENTRELESS  
GRINDER  
work rests

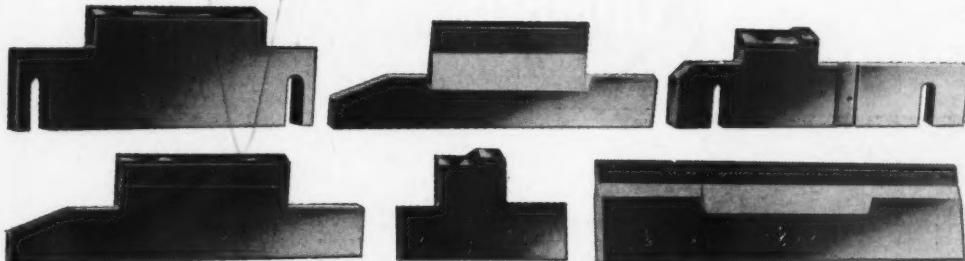


up to  
100 times  
more life

**ADVANTAGES**

1. The high wear-resistance of Wimet gives a life of up to 100 times that obtained from conventional steel blades.
2. Long life helps to assure the maintenance of high accuracy in the work produced.

Standard sizes and styles for PLUNGE and THROUGH - FEED GRINDING available for all machine makes



587

**WICKMAN**

WIMET DIVISION, TORRINGTON AVENUE, COVENTRY.

"Wimet" is the Registered Trade Mark of Hard Metal Tools Ltd., a Wickman associated company



**LIMITED**

Telephone: Coventry 66621

A



Photo by courtesy of BEANS INDUSTRIES LTD

SPECIAL

**3-spindle Tracemaster  
FOR PROFILE MILLING  
COMBUSTION CHAMBERS**

IN STANDARD MOTOR CO. LTD. CYLINDER HEAD



HAYES ENGINEERS (LEEDS) LTD

GELDERD ROAD, LEEDS 12 TEL: 30941 GRAMS' 'TOOLMAKER' LEEDS 12

SOLE SELLING AGENTS FOR HOME & OVERSEAS: ASSOCIATED BRITISH MACHINE TOOL MAKERS LTD., 17 GROSVENOR GARDENS, LONDON, S.W.1

November 1, 1961

MACHINERY

3

# FIGURES TELL THEIR OWN TALE

The intelligent use of  
**DYSON'S**  
LABORATORY CONTROLLED  
PRESSURE DIE CASTINGS  
can cut your production  
costs

OUR TECHNICIANS WILL GLADLY TELL YOU HOW THE  
LATEST DEVELOPMENTS CAN BE APPLIED TO YOUR  
OWN PRODUCTS. GET IN TOUCH WITH US



**DYSON & CO. ENFIELD (1919) LTD**  
SOUTHBURY WORKS, PONDERS END, MIDDLESEX  
TELEPHONE HOWARD 1484



Using basic components, seven different arrangements are possible as shown above. Spindle drive motors can be mounted at right, left or on both sides with single or double spindles; two machines can be placed side-by-side or used with other production machines.



# The 4 BIG Features of Ex-Cell-O's New 411 Vertical Ar- Importan To Yo

- 1. QUICK TOOL CHANGING**—Tool changing and adjusting is fast and easy because of "clean" design and placement of the Model 411's components.
- 2. EASY PARTS HANDLING**—Vertical construction lends itself to safe, easy loading and unloading of parts in a wide variety of shapes and sizes.
- 3. SINGLE COLUMN CONSTRUCTION**—Solid base-column gives firm support to the hydraulically-operated compound tool slide. Rugged, simple

construction assures maximum accuracy and efficiency, plus long life with lowest maintenance.

**4. PRODUCTION VERSATILITY**—The all-new Model 411 performs turning, boring, racing, grooving, limited contouring and chamfering operations singly or in combination. Often, both sides of disc-type parts can be machined simultaneously. Contact your Ex-Cell-O Representative or write direct for details.

## EX-CELL-O FOR PRECISION

AGENT: Ex-Cell-O Group Sales Ltd.  
Halford House, Charles Street, Leicester  
Telephone: LEicester 26791  
Telex: 50101 EXCOPLEX, Leicester

**EX-CELL-O CORPORATION**

(ENGLAND) LTD.

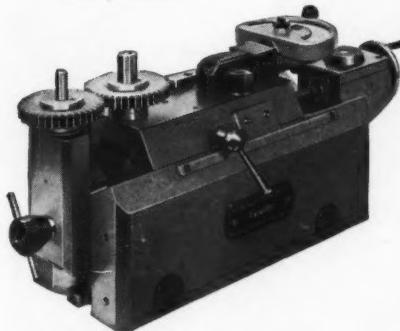
HASTINGS ROAD, LEICESTER



Goulder

## GEAR MEASURING EQUIPMENT

*This series of advertisements is intended to show how attention to detail design backed by careful and precise manufacture has made Goulder gear measuring equipment first choice of buyers who appreciate these qualities.*

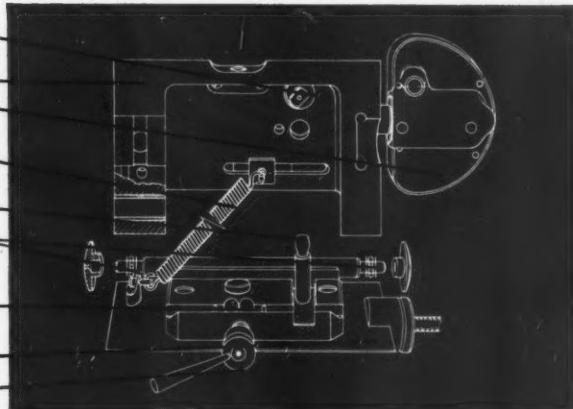


### ROLLING TESTER

### SADDLE ASSEMBLY

used on Goulder No. 1 Rolling Tester to measure variations in centre distance as two gears are rolled together under spring pressure and hence composite gear errors. Special layout of saddles allowing 1, vertical adjustment for gear under test 2, extra sensitivity 3, reduced bed length.

- CAM ACTION CENTRALISING LOCK TO PROVIDE DATUM
- FLOATING SADDLE IN NITRALLOY STEEL
- MICRO-INDICATOR AS ALTERNATIVE TO ELECTRONIC RECORDER
- SPRING TO PROVIDE ADJUSTABLE MEASURING PRESSURE
- STYLIUS ABUTMENT PEG
- REAR BEARINGS CONSISTING OF TWO RINGS OF BALLS CARRIED ON A HARD STEEL SHAFT IN A HARD STEEL BUSH
- FRONT BEARINGS CONSISTING OF TWO BALLS CARRIED IN HARD VEE AND FLAT BEARINGS
- SLIDING SADDLE IN HARDENED NITRALLOY STEEL
- CAM ACTION LOCK FOR CENTRE DISTANCE SETTING




Goulder

THE NAME FOR ALL GEAR TESTING

J. Goulder & Sons Ltd., KIRKHEATON, HUDDERSFIELD. Tel: Huddersfield 5252-3

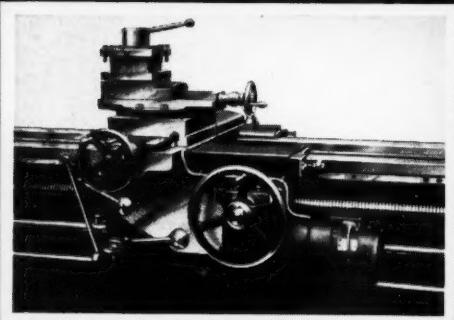
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**CROWTHORN**

## HEAVY DUTY LATHES



The illustrations show a Crowthorn 18 in. Centre x 27 ft. 9 in. Gap Bed Lathe admitting 20 ft. 6 in. between Centres and, inset, a view of the quick power traverse mechanism. The lathe is typical of Crowthorn Heavy Duty Long Bed Lathes.



### some notable features of the lathe

1. Special heavy duty tailstock with built-in Timken roller bearing assembly.
2. Bed casting of very heavy section for rigidity and accuracy.
3. Quick power traverse to carriage by means of flange mounted motor and cable reel.
4. Heavy duty steadyes with needle roller bearings.
5. Heavy duty grinding attachment available for mounting on cross slide in place of toolpost.
6. Taper turning attachment.
7. Micrometer dead stop.

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*Makers of High Class Machine Tools for over half a century*

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*Phone: STOCKPORT 7271-2-3*

*Grams: CROWTOOL, REDDISH*







**70%**  
**machining time**  
**saved with**  
**Harper**  
**SG iron castings**



Tritex Engineering Limited, who build hosiery machines, had trouble with their castings—until they came to Harpers. At first they used phosphor bronze, but this did not have the strength required for their sinker rings. To obtain this strength they next used malleable iron, but this increased machining time, cutter wear and scrap rate.

Now Tritex use Harper Spheroidal Graphite annealed iron with the result that they have castings with all the qualities they require. Machining takes 30% of the previous time, and the distortion experienced with malleable iron has been eliminated. Production costs on the sinker rings are lower than ever—thanks to Harpers.

# HARPER Castings

Harpers will be pleased to send you a booklet which describes their castings in SG iron, grey iron and Harper-Meehanite (the word 'Meehanite' is a registered trade mark). On Lloyd's List for SG iron and Meehanite castings. Metal pressings, machining, enamelling and sub-assembly work are all part of the Harper service.



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**JOHN HARPER & CO. LTD · WILLENHALL · STAFFS**

Telephone : Willenhall 66601 (7 lines)

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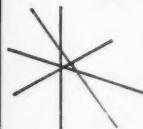
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POOLE FOUNDRY LTD. Poole 212

Also makers of the famous Beatrice Oil Heaters & Harper Housewares

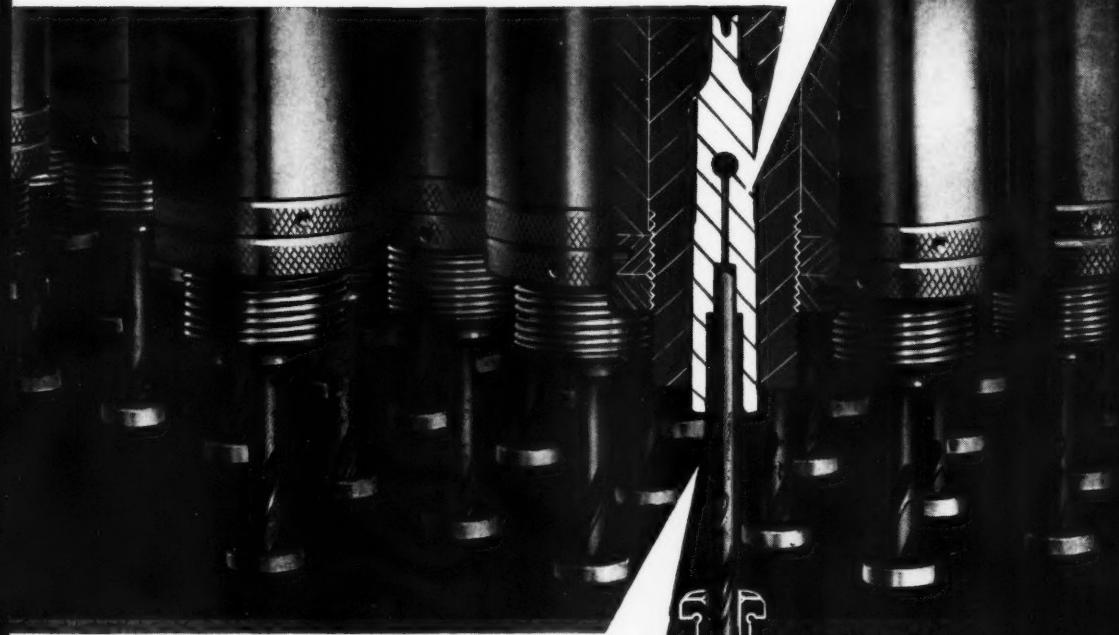
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ANOTHER



DORMER

ECONOMY



or repetitive drilling of any particular size of hole, where a taper drive is required, considerable savings can be effected by using a DORMER Conversion Sleeve and straight shank drills with tang. One sleeve outlasts numerous drills—replacement straight shank jobber drills are cheaper than those with taper shanks.

Additionally, this drive permits drilling to much closer centres than with the conventional straight shank drill chucks—more holes can be drilled simultaneously.

A comprehensive range of DORMER Drills are available with tanged straight shanks.

Descriptive brochure available.

THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LIMITED  
SHEFFIELD ENGLAND

DORMER TOOLS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS

CONVERSION SLEEVES AND  
TANGED STRAIGHT SHANK DRILLS





November 1, 1961

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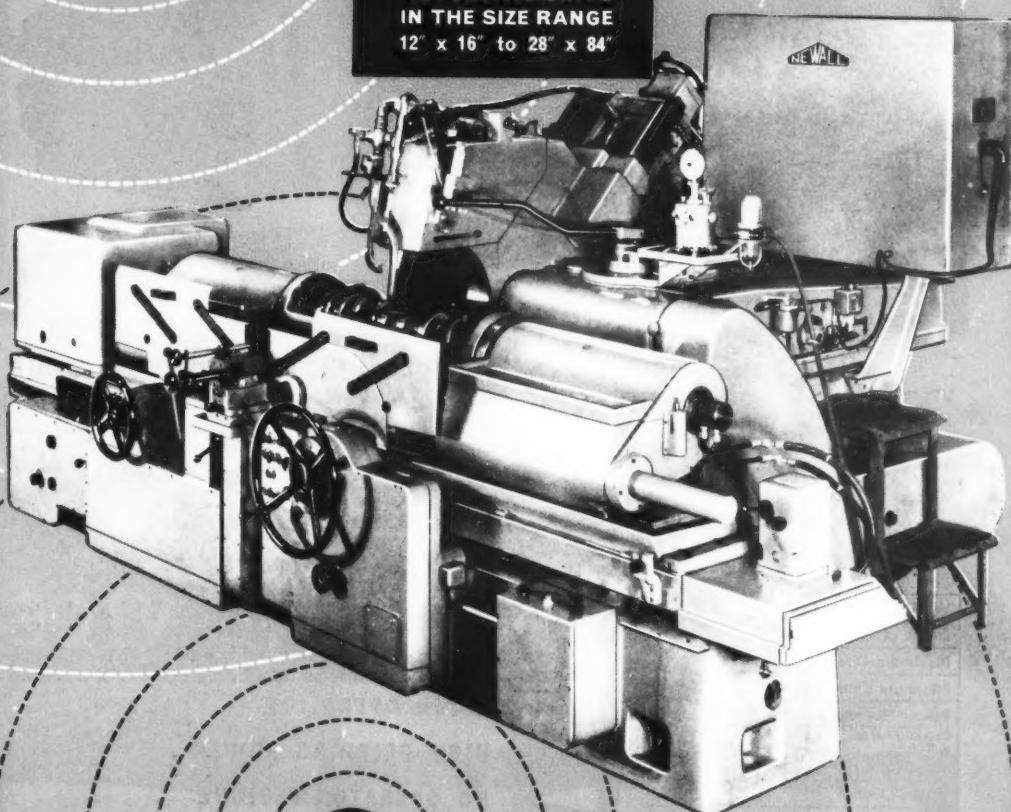


ESTABLISHED IN 1900

# HAC

## CRANKPIN GRINDING MACHINES

SEMI AND FULLY  
AUTOMATIC UNITS  
IN THE SIZE RANGE  
12" x 16" to 28" x 84"

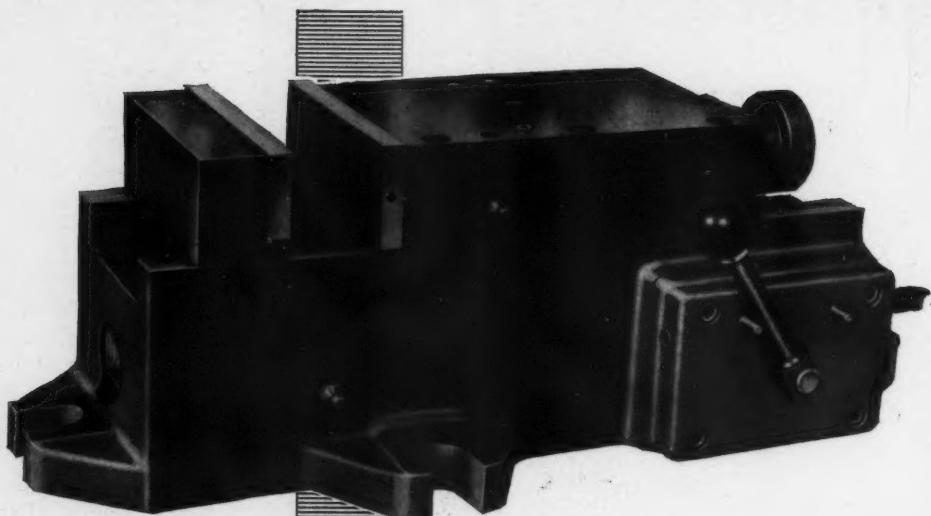


BUILT THROUGHOUT TO J.I.C. STANDARDS

**NEWALL GROUP SALES LIMITED**

PETERBOROUGH TELEPHONE 3227 OR KEIGHLEY TELEPHONE 4294

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*The*

# PRATT

**PRINCIPAL DIMENSIONS**

Width of Jaw	4 $\frac{1}{2}$ "	6"
Depth of Jaw	1 $\frac{1}{2}$ "	1 $\frac{1}{2}$ "
Maximum Opening	2 $\frac{1}{2}$ "	4 $\frac{1}{2}$ "
Minimum Opening	0"	1 $\frac{1}{2}$ "
Power Movement	1"	1"
Gripping Force at 90 P.S.I.	4,800 lbs	7,700 lbs
Length Overall	15 $\frac{1}{2}$ "	19 $\frac{1}{2}$ "
Width Overall	7 $\frac{1}{2}$ "	9 $\frac{1}{2}$ "
Height Overall	5 $\frac{1}{2}$ "	6 $\frac{1}{2}$ "
Weight (approx.)	54 lbs	126 lbs

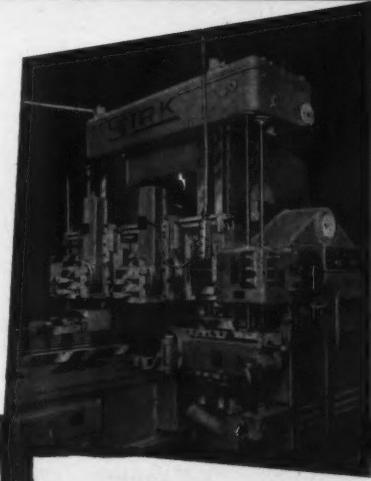
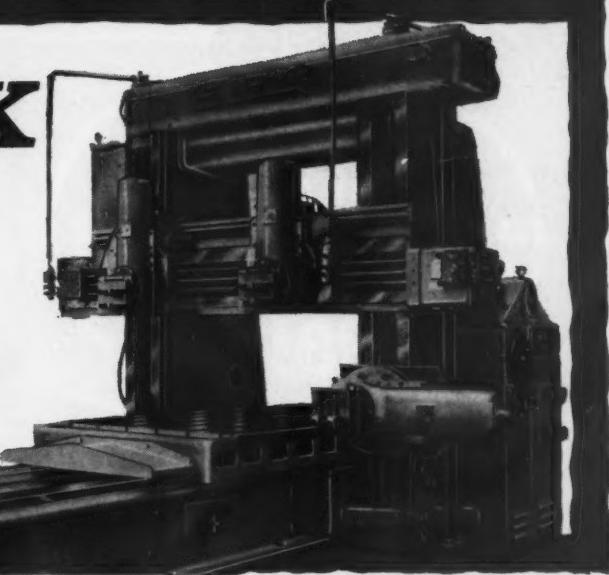
## PNEUMATIC MACHINE VICE

**RAPID OPERATION****HIGH GRIPPING POWER****NO OPERATOR FATIGUE****ROBUST CONSTRUCTION****AMPLE BEARING SURFACES****FOR INCREASED PRODUCTION**

F. PRATT & CO. LTD. HALIFAX ENGLAND  
*Famous for Workholding for 100 Years*

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**STIRK  
PLANERS  
SET THE  
STANDARD**



The modern Stirk Planer, with built-in electrical equipment, possesses many distinctive features which make it one of the world's finest planing machines.

The easy control and fine accuracy of the modern planing machine is due in no small measure to the continuous development of Stirk Planers. For more than fifty years Stirk Planers have influenced the design and set the standard by which others are judged.

**JOHN STIRK & SONS LIMITED**

**HALIFAX - ENGLAND**

**OVERSEAS AGENTS.—**

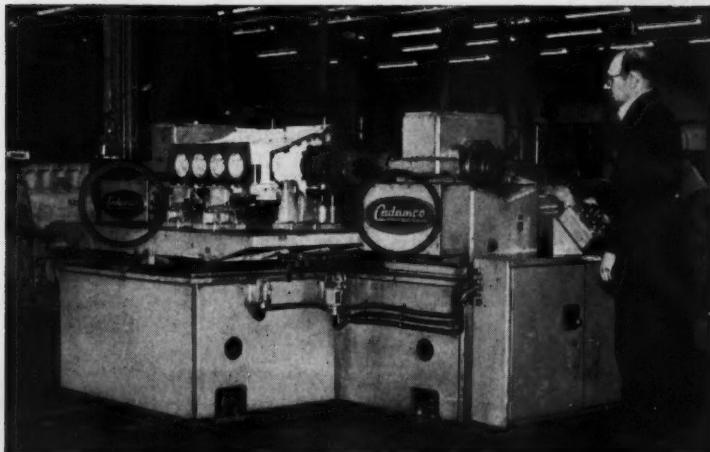
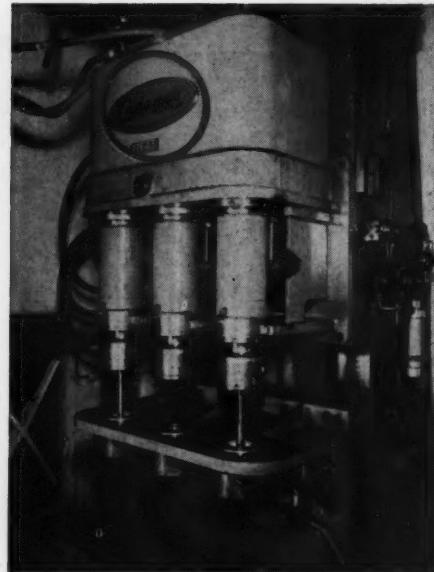
AUSTRALIA: Gilbert Lodge & Co. Ltd., 386, Harris Street, Ultimo, Sydney, N.S.W. CANADA: Williams & Wilson Ltd., 544, Inspector Street, Montreal. FRANCE: Societe Anonyme Alfred Herbert, 1 and 3, Rue du Delta, Paris (9<sup>e</sup>). HOLLAND: Esmeijer & Co., Oosterkade 24, Rotterdam C. INDIA: Alfred Herbert (India) Ltd., 13/3, Strand Road, P.O.B. 681, Calcutta 1. NEW ZEALAND: Gilbert Lodge & Co. Ltd., Head office: 55, Station Road, P.O. Box 12-063, Penrose, Auckland, S.E.6. N.Z., also at Christchurch and Wellington. PAKISTAN: Guest, Keen & Nettlefolds in Pakistan Ltd., P.O.B. 819, Bank of India Buildings (3rd Floor), Bunder Road, Karachi. SPAIN: Gumuzio S.A. Gran Via 48, Apartado 920, Bilbao. KENYA, UGANDA, TANGANYIKA & ZANZIBAR: Len Cooper Ltd., P.O.B. 3796, Nairobi, Kenya. SWEDEN: Aktiebolaget Servus, Malmkillnadsgatan 46, Stockholm.



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Machines that are hard at work on current production are the best evidence of our ability to provide the right design and a high standard of manufacture.

If you are seeking an enthusiastic 'out-of-the-rut' approach to your machinery problems you will find us keen to help you at a competitive price.



A multi-spindle cavity boring machine specially manufactured by us for the War Office. This machine has a fully automatic cycle and bores a number of shell cavities simultaneously to two diameters.

We designed and manufactured this cylinder block milling machine for Caterpillar Tractor Co. Ltd. It enables twelve bearing boss faces of a Diesel engine cylinder block to be completed in one operation.

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*Designers and Manufacturers of Jigs, Fixtures and  
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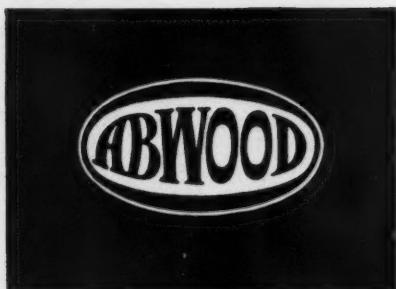




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TOOL CORPORATION LIMITED  
OPENSHAW, MANCHESTER

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**HIGH  
PRECISION  
TOOL & DIE  
SURFACE  
GRINDER**

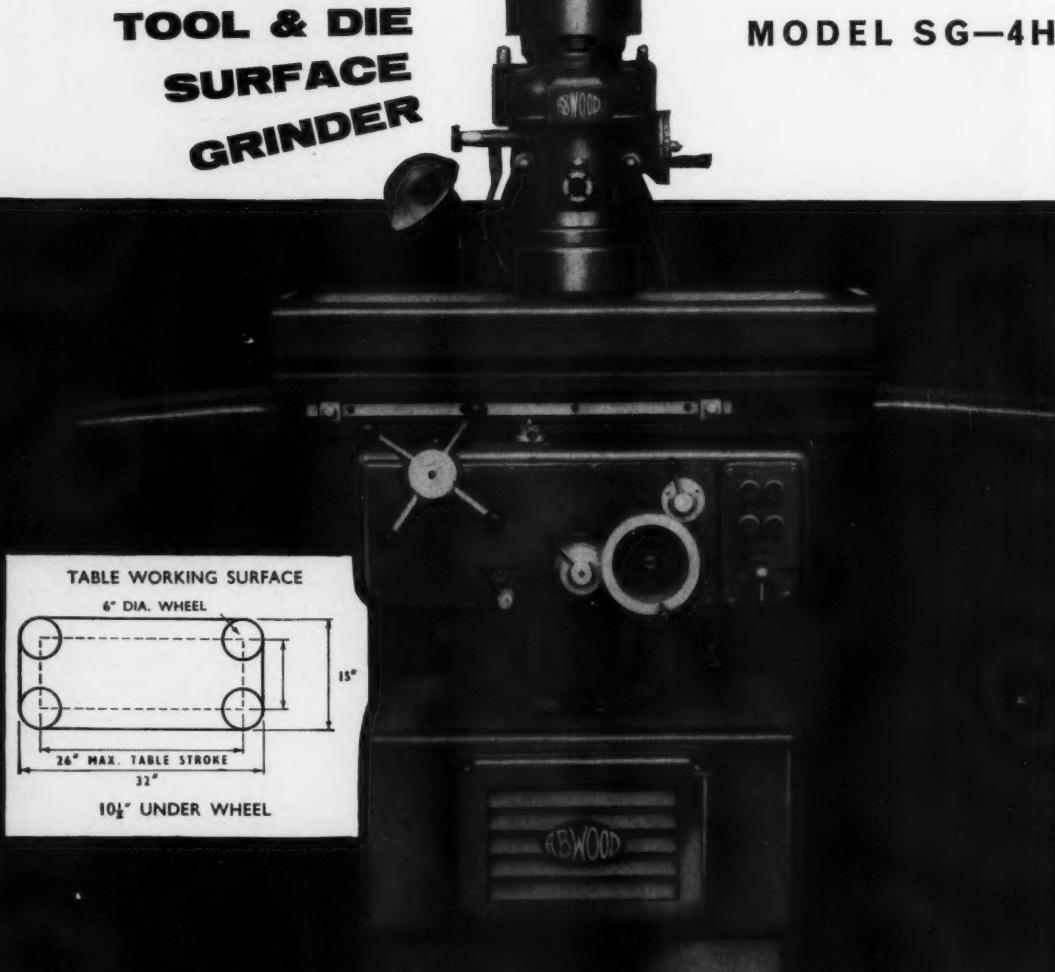
Traversing head for positioning wheel anywhere on table so that dies can be ground without removing pins.

Infinitely variable hydraulic or manual table traverse.

Automatic infeed for depth of cut. Guaranteed flatness of work and surface finish to 1.5 micro-inches on suitable materials. Segmental chuck available for maximum stock removal. Automatic pressure lubrication to all parts.

Rapid power rise and fall of knee. Large capacity mobile coolant tank with sludge settlement tray.

**MODEL SG-4H**



ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

SG1

Telephone: Dartford 25271 (5 lines). Telegrams: ABWOOD, DARTFORD

# NEW MODEL "S" SUPER CHUCK

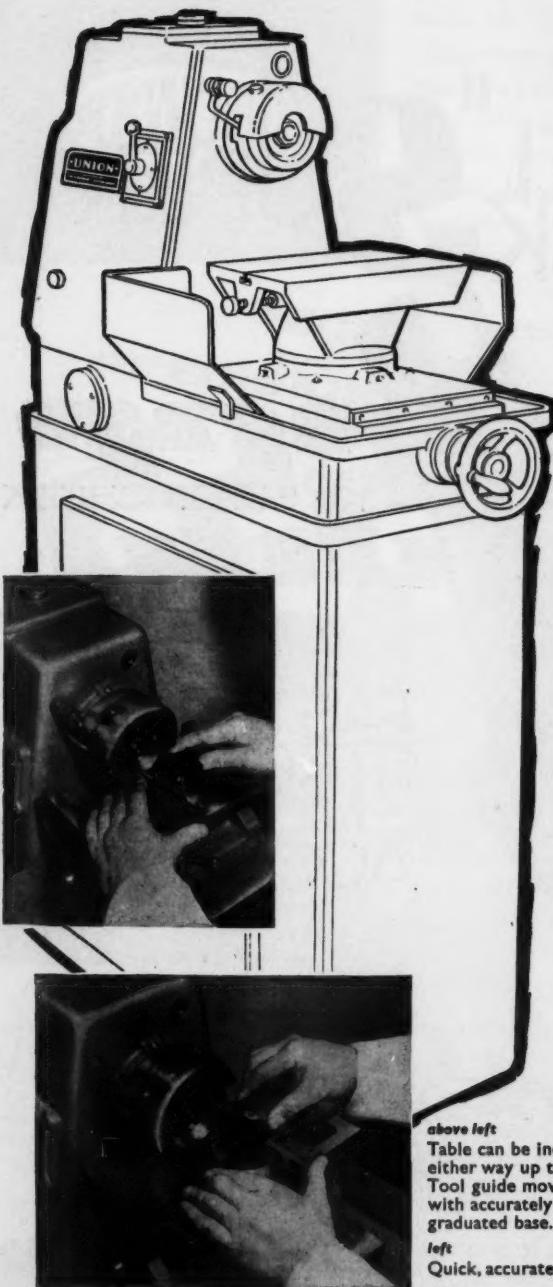


FASTER  
STRONGER  
MORE  
ACCURATE

*Clarkson*  
**S** type AUTOLOCK

CLARKSON (ENGINEERS) LIMITED  
KING EDWARD ROAD, NUNEATON, WARWICKSHIRE  
BRANCHES AT LONDON, CROYDON, BARKING, ENFIELD, BIRMINGHAM, BELFAST,  
BRISTOL, COVENTRY, LEEDS, GLASGOW, HAYES, MANCHESTER, NEWCASTLE,  
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L. L. F. series available covers the Harrison range of Lathes from 9" to 17" swing; Milling, Drilling and Grinding Machines and Engineers Accessories.

# GET MORE FROM YOUR CARBIDE TOOLS

*with this inexpensive,  
robustly built*

## UNION LAPPING AND CHIPBREAKER GRINDING MACHINE

Lapping carbide tools after grinding improves performance, prolongs re-grinding intervals and gives a superior finish to the turned part.

### BRIEF SPECIFICATION:

4,800 r.p.m. spindle on opposed Timken bearings.  
Lapping speed 5,000 surface f.p.m.  
In-built coolant pump and tank.  
Fully adjustable table on ball bearing slideways.  
Supplied as bench or cabinet model



*above left*  
Table can be inclined either way up to 20°.  
Tool guide moves 90° with accurately graduated base.

*left*  
Quick, accurate setting.  
*right*  
Vertical feed with adjustable micrometer dials.

**SEND FOR FULLY  
ILLUSTRATED  
LEAFLET—TODAY!**

**T. S. HARRISON & SONS LIMITED • HECKMONDWIKE • YORKSHIRE**

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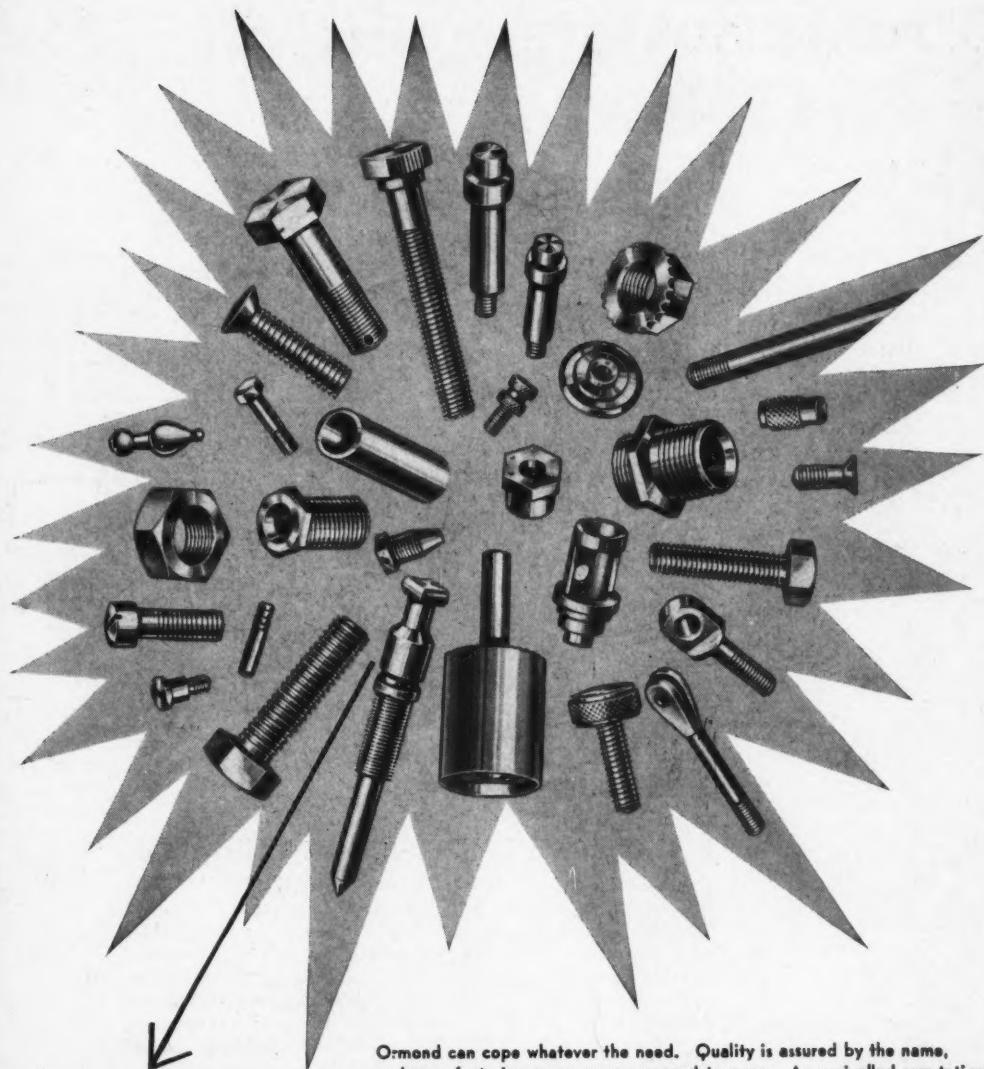
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# Repetition work

Ormond can cope whatever the need. Quality is assured by the name, and manufacturing resources are second to none. An unrivalled reputation for service takes care of prompt delivery. Please ask us to quote. Any quantity.

The Repetition Parts range covers single and multi spindle automatics up to 1½" dia., Brass, Steel and Light Alloy Screws in Rolled and Cut Threads, Grubsscrews, Nuts, Allthreads, Hexagon Bolts and Setscrews turned from bar and Cold Headed Grades "A", "B", and High Tensile.



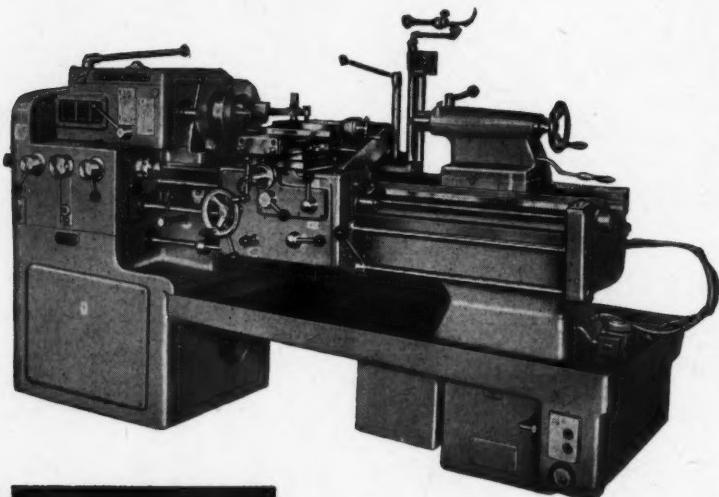
**THE ORMOND ENGINEERING CO. LTD.**  
**ORMOND HOUSE • ROSEBERY AVENUE • LONDON, E.C.1**

Telephone: TERminus 2888

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# Profile cutters copied and relieved simultaneously



SWISS

**MENZIKEN**

## HYDROCOPYING RELIEVING LATHE MODEL M200

Profile turning and relieving simultaneously, the MENZIKEN M200 offers unique advantages for producing form milling cutters rapidly, accurately, economically. Setting the spiral angle can be quickly and accurately effected. Both axial and radial relieving can be performed, and copying from flat or cylindrical masters. Copying by single point tool, wide forms can be produced quickly with chatter-free finish. The relieving mechanism can be readily disconnected for normal turning. 25 English, 24 metric and 24 module screw cutting pitches are available and a wide range of equipment for special jobs.

*Centre height 8". Distance between centres 60".*

*Spindle speeds 1½ to 1130 r.p.m. 30 Longitudinal and 30 cross feeds*

**Send for the fully illustrated brochure M/184.**

SOLE U.K. DISTRIBUTORS



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222

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# Now-Really *FAST* Pressing

on the NEW 5, 10 and 15 ton



## HIGH SPEED HYDRAULIC PRESSES

Built solely for 'D & D' by Rhodes, Gill & Co. Ltd., specialists in high pressure hydraulics. Entire mechanism enclosed within sturdy fabricated steel frame. High ram speeds plus positive power return. Working pressure and slow advance for setting easily controlled. Pressure gauge and isolating valve provided. Compactly housed ram guides cannot foul pillars of die sets. Perspex guards available providing unobstructed view of entire table.



*5 ton bench and pedestal models.  
10 and 15 ton models available  
with stroke limiting device  
(provides extremely accurate  
"inching"), T-slotted tables and  
automatic rotary indexing table.*

	5 TON	10 TON	15 TON
STROKE	4"	8"	10"
TABLE SIZE	14" x 11½"	16" x 14"	18" x 16"

sole World Distributors.

Inspect these Presses at our Showrooms



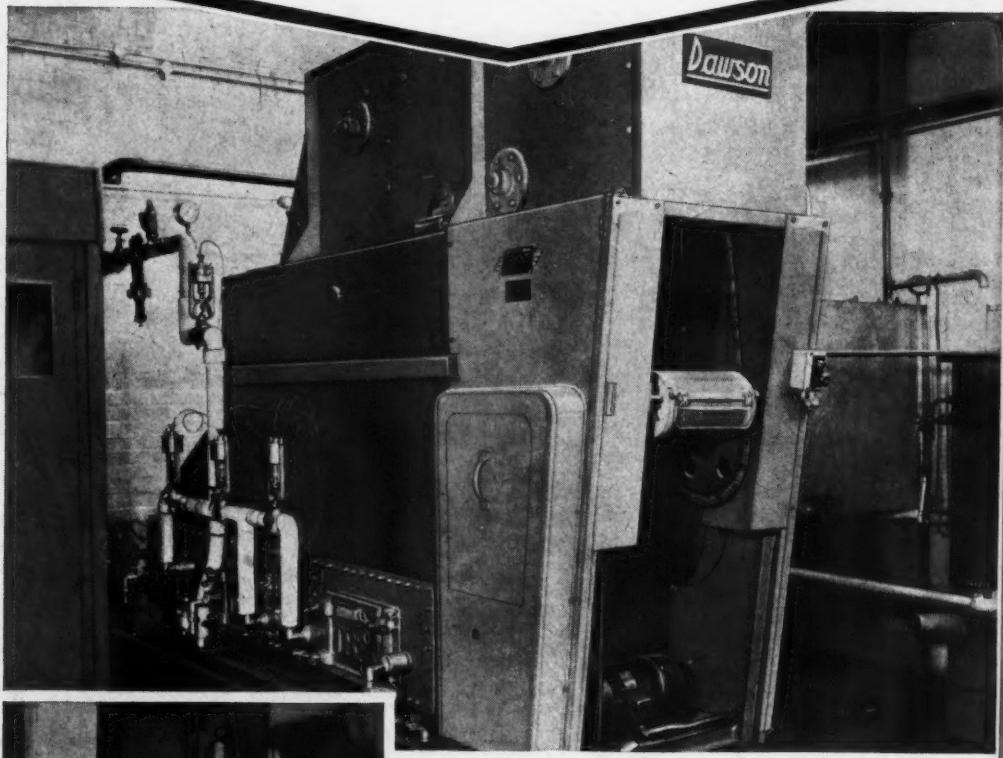
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for illustrated  
brochure M/222

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# DAWSON Automatic Solvent Degreasing Plant

at MALLORY BATTERIES LTD. Dagenham



The operator is seen loading the battery cases into one of the rotating baskets attached to the continuous conveyor of the machine

Photographs by kind permission of Mallory Batteries, Ltd.

At Mallory Batteries, Ltd., in Dagenham, a vital necessity in the mass production of the miniature batteries for deaf aids and similar compact applications is that the cases should be completely clean before assembly. This important function is carried out by a Dawson automatic Solvent Degreasing Machine. The cases are carried through an automatically timed and controlled double immersion/vapour treatment in rotating baskets attached to a continuous conveyor. The gentle tumbling action ensures that none of the cases escape the powerful degreasing effect of the solvent. On emerging from the machine they are clean, dry and completely odourless. This machine is of the return type, the parts being loaded and unloaded at the same end by one operator. For full details of Dawson continuous operation and batch operation solvent degreasing equipment get in touch with Drummond-Asquith Limited.

**Dawson**

METAL DEGREASING  
and  
PRE-TREATMENT  
PLANT

Manufacturers: DAWSON BROS. LTD., Gomersal, Near Leeds.  
LONDON WORKS, 406 Roding Lane South, Woodford Green, Essex.

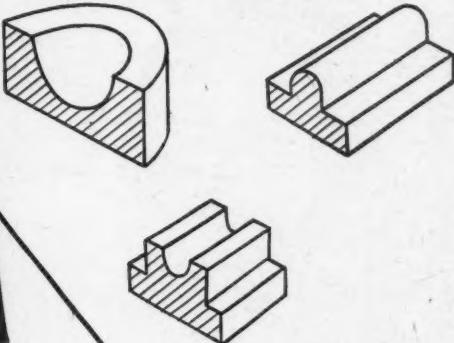
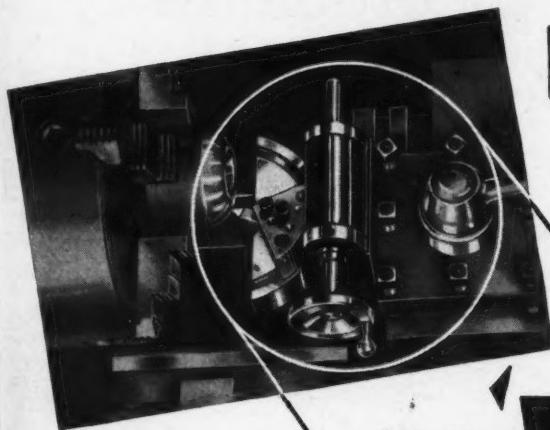
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Sole Distributors  
**DRUMMOND - ASQUITH LTD.**  
King Edward House, New St., Birmingham  
Tel. Midland 3431

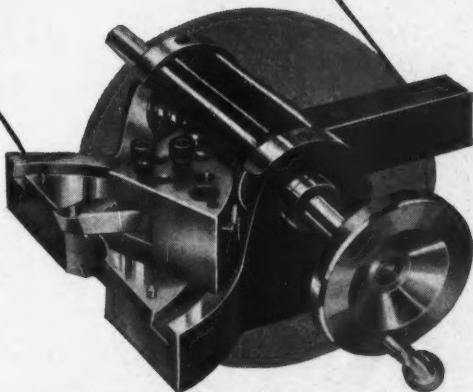
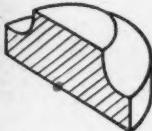
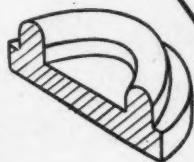
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## Adapt your Lathes and Shapers for SPHERICAL TURNING...



with the **HABIT**  
**TURN-A-ROUND**  
SPHERICAL TURNING ATTACHMENT



Ltd.  
the mass  
compact  
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Solvent  
automatically  
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For full  
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Accurate spherical turning and convex and concave radius forming on lathes and shapers is simplicity itself with the TURN-A-ROUND — another HABIT toolroom innovation. Clamp it in the toolpost — set it with the aid of a simple chart — and turn the handle. A full 90° radius can be produced in one setting, or with twin tool bits — 180° of arc can be covered. The HABIT TURN-A-ROUND is versatile, robust, needs no special skill and will prove to be a vital part of every toolroom's equipment and every turner's kit.

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**HABIT GEOMETRIC TOOLING**  
LURGAN AVENUE : LONDON W.6  
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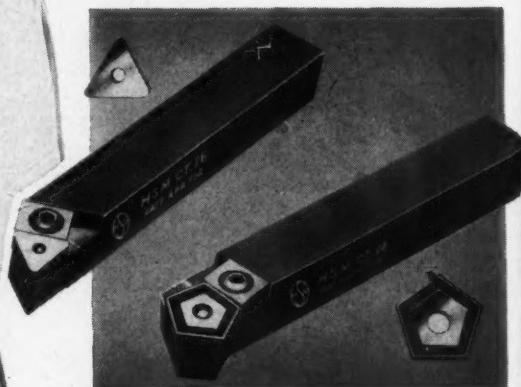
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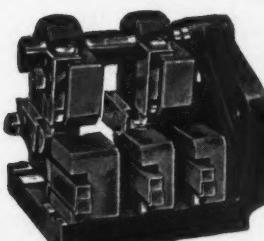
*Literature available on request.*

Tungsten Carbide Tips, Lathe tools,  
Milling Cutters, Special Cutters,  
Special Reamers, Special Drills.

**HIGHER SPEED METALS LTD**  
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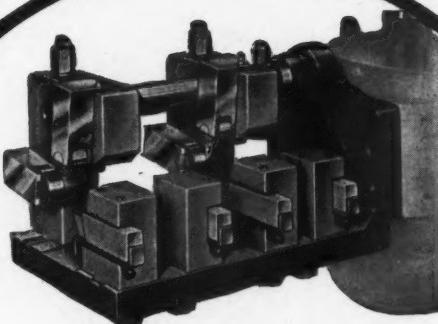
*For stepped diameters at High Speeds*



MULTIPLE TOOL HOLDER  
FOR CAPSTAN LATHES

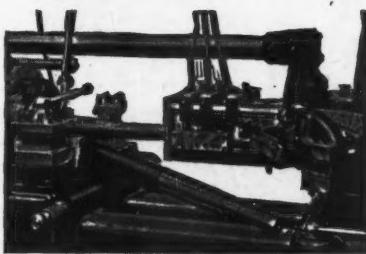
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Constructed for turning one, two, three or more diameters with tungsten-carbide tools, these holders present the tools to the work in quickly set robust slides having independent adjustment. The roller holders are interchangeable and can be locked in any position along the body.

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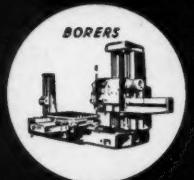
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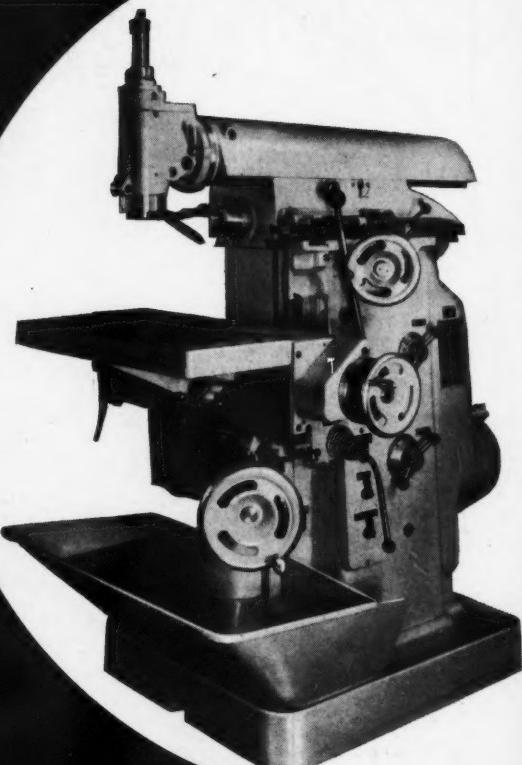


Table	Model 58	Model 59	Model 58	Model 59
Working surface	10 $\frac{1}{2}$ " x 28 $\frac{1}{2}$ "	12 $\frac{1}{2}$ " x 32 $\frac{1}{2}$ "	Spindle speeds	
Longitudinal traverse	12"	14"	Vertical spindle	102—1,250 r.p.m.
Vertical movement (Power or hand)	12"	14"	Horizontal spindle	67—825 r.p.m.
Ram movement (Power or hand)	10"	12 $\frac{1}{2}$ "	H.P.	2 4
			Taper	30 INT. 40 INT.

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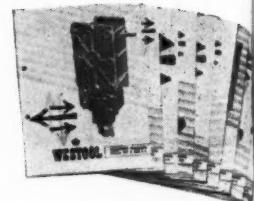
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Westool Solenoids provide design engineers with a convenient and simple means of mechanical actuation and control. Being electrically operated and self-contained, they can be fitted almost anywhere to provide a prime mover right where it is needed. Westool Solenoids are design approved by The Ministry of Supply. Wide standard range.



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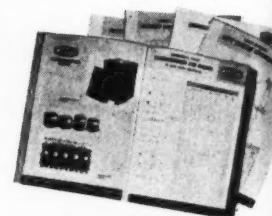
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## TRANSFORMERS & CHOKES

Westool transformers range from the smallest possible up to 2,000 VA for sealed can types and from 5k VA single-phase to 18k VA three-phase.

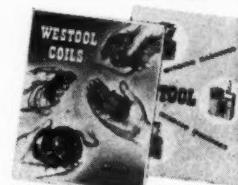
Transformers and chokes are made to customers' specifications—or designed to meet customers' specific needs. Stringent tests at every stage of manufacture.



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### Transformers & Chokes

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Complete name and address details below and post—no stamp is needed.

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NAME & ADDRESS OF COMPANY.....

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**WESTOOL**  
LIMITED

ST. HELEN'S AUCKLAND  
Co. DURHAM

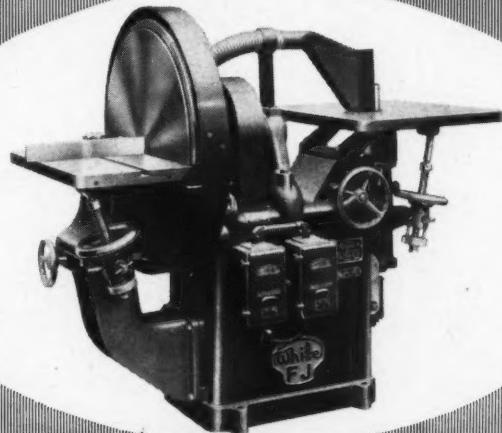
Telephone: West Auckland 551 (6 lines)  
Telexograms: Solenoid, West Auckland  
LONDON

2 Ashley Place, Carlisle Place, SW1  
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A sturdily built and versatile sander, the White F.J. carries a 30in. disc and a standard bobbin of 3½in. dia., 8in. long.

The disc is of cast iron, carefully machined, and balanced and slightly cambered for working long wood. The paper mounting method is designed for quick changing. The bobbin has a totally enclosed oscillating gear of special design and runs at 2,900 r.p.m. The machine is complete with electrical equipment.

The disc table carries a fence which can angle 45° for mitred work. A quick-setting lock holds the table in any position. The bobbin table will cant 30° in either direction.

This is a first-class precision machine at a competitive price and early delivery is possible. Write today for full details.

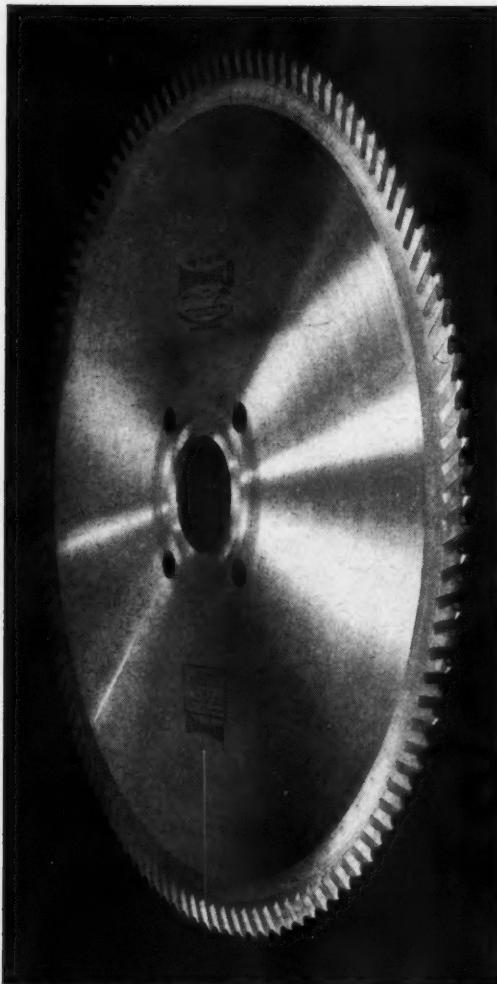


**machines work wonders with wood**

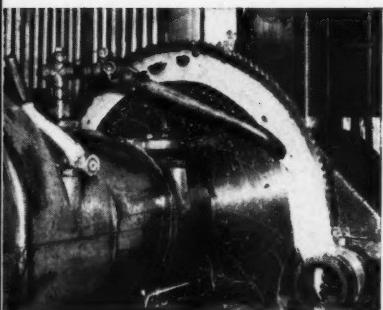
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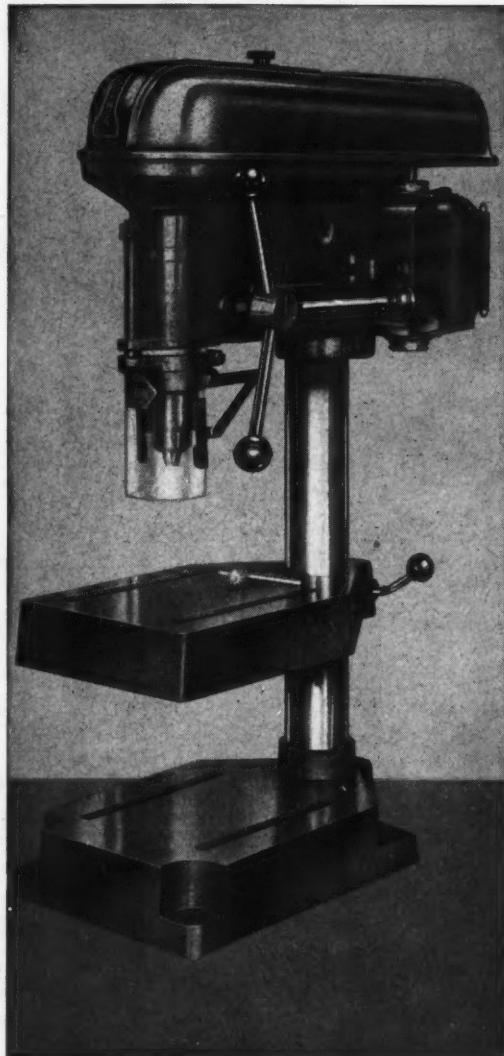
Made in sizes from 11" to 60" diameter with tooth segments of SABEN EXTRA high speed steel for maximum life between re-grinds.

*Details on application.*

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# INCOMPARABLE IN PRICE & QUALITY

- Weight 154 lbs. 70 kgs.
- Five Spindle Speeds
- Throat Depth  $7\frac{5}{8}$ " : 194 mm
- Column Diameter  $2\frac{3}{4}$ " : 70 mm
- Quill Diameter 2" : 50.8 mm
- Robust Spindle and Quill Assembly with splined spindle and driving sleeve
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Supplied complete with 0-4in. Chuck,  
3 phase motor, rotary on/off starter.  
Pedestal model £2.15.0 Extra. Single  
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**£42**



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Obtainable from all leading Machine  
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**THOMPSON-DIATEST  
GAUGE WITH RIGHT-  
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No. E100**

Permits the checking of bores without removing the workpiece from the machine. Maximum space required between workpiece and tool is  $\frac{1}{4}$ " plus length of measuring unit. Side-ways movement of dial gauge can be extended as desired.



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DEPTH ADJUSTER  
No. E107**

The unit depth adjuster permits the checking of bores of any defined depth and is especially useful for checking large numbers of similar components. By the use of extension rods measuring depth can be adjusted to suit any needs.



**THOMPSON-DIATEST  
Complete Sets . . .**

A range of nine standard sets in English or metric arranged in various combinations. A separate leaflet is available giving complete details of these sets which cover all needs from 0.038" up to 1.610" dia. (1 mm. — 40 mm.)

Write for full details of all THOMPSON-DIATEST accessories available . . . to the sole importers :



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*High Precision*  
**SMALL BORE  
 GAUGES**

*. . . . . a complete range  
 of equipment to solve your  
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**NO MORE TROUBLE GAUGING . . .**

. . . blind bores, tapered bores, incomplete bores, barrel shaped bores, out-of round bores, where other bores interfere.

- ★ THOMPSON-DIATEST gauges can be operated by unskilled labour.
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- ★ Simple adaptor converts the THOMPSON-DIATEST into an electronic bore comparator in conjunction with the MAGNA-GAGE or PARNUM.
- ★ Range 0.038" to 1.610" (1mm. - 40 mm.)

*All Parts Interchangeable*



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TELEGRAMS: TOMTOOL, LONDON W.6

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## QUALITY STEELS FOR BRIGHT DRAWING



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THE PARK GATE IRON & STEEL COMPANY LIMITED ROTHERHAM  
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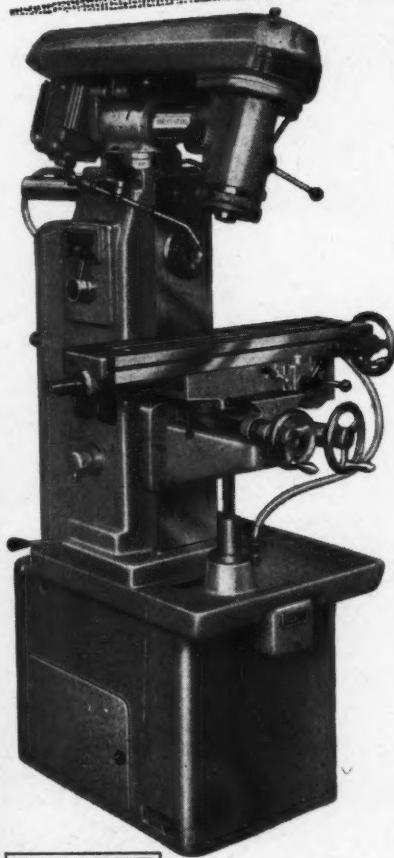
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November 1, 1961

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**Versatility with Economy!**



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### junior-OMNIMIL

- Ideally suited to small jig, tool, die and fixture work.
- 7 Vertical spindle speeds 200 - 3,600 r.p.m.  
Vertical head motor  $\frac{1}{2}$  h.p.
- 8 horizontal spindle speeds 100-1700 r.p.m.
- 6 table feeds .009", .018", .036", .0018", .0036", and .0072".

On Both Machines

Optical measuring equipment, dividing heads, slotting attachment and universal attachment available as extra equipment.

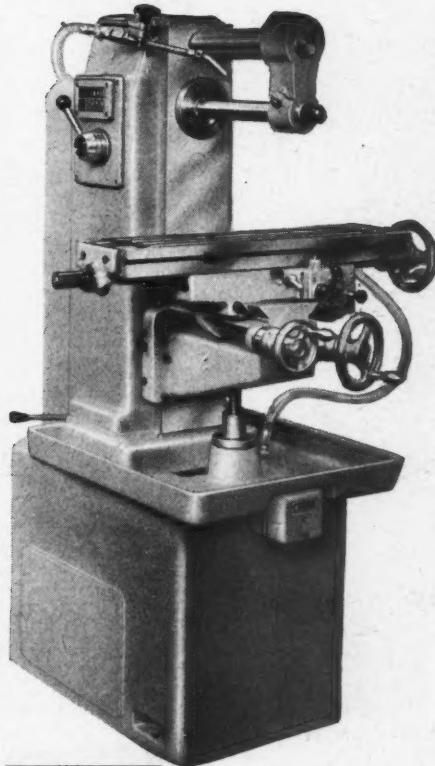
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TWO IMPORTANT ADDITIONS  
NOW FIRMLY ESTABLISHED  
IN THE FAMOUS  
ELLIOTT-VICTORIA  
MILLING MACHINE RANGE



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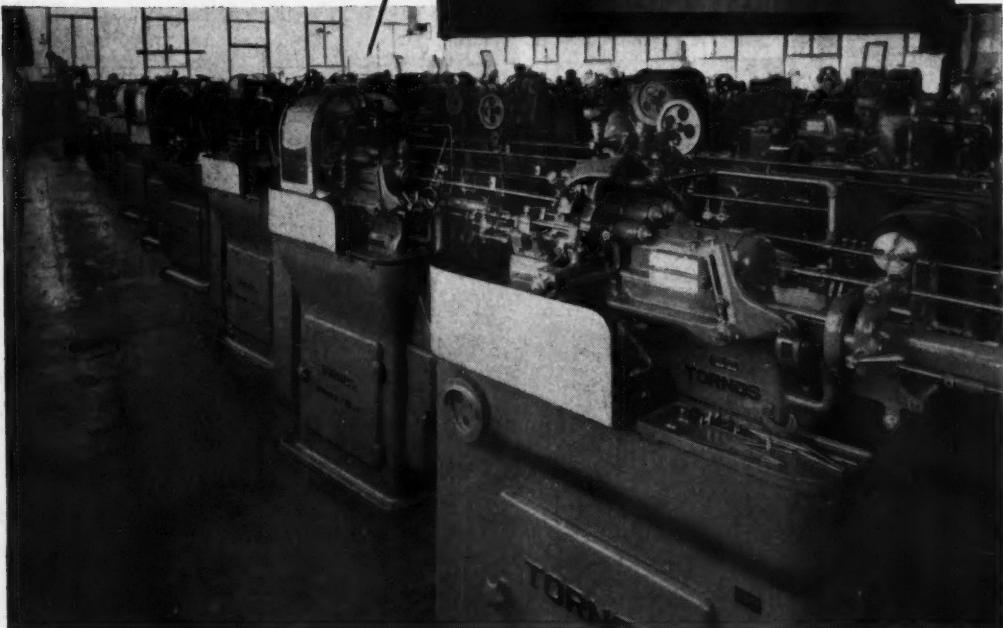
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- Especially designed for economical and accurate milling of small components.
- Table size 28" x 7".
- Working surface 28" x 7".
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MRP 2750

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on parts  
SMALLER  
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pin head**



*In the watch factory of S. SMITH & SONS (ENGLAND) LTD.*



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The TORNOS sliding head automatic with its unequalled performance, is ideally suited to the large scale production of both simple and intricate high precision parts. Eight models are available in the TORNOS range, with stock capacities from four to 32 mm. Write for full details.

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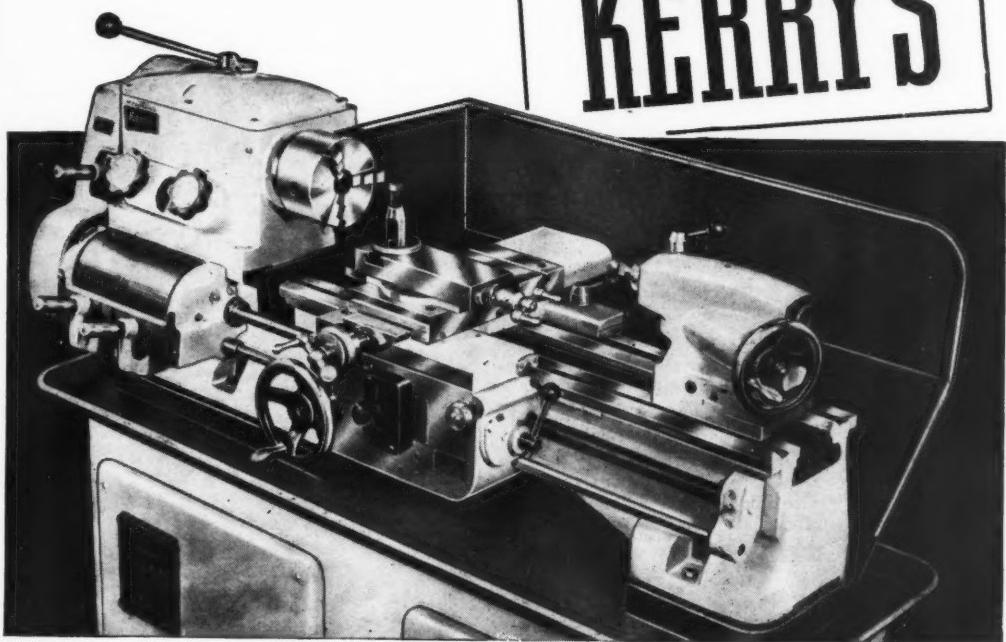
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**KERRY'S**



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*THOUSANDS in use in Great Britain  
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**with 5, 6, 8 or 10 ft diameter work tables**

These incomparable machines are massively constructed for years of hard service. Accuracy and dependability are of the high order that industry has learned to expect of Broadbent Machine Tools. Notable features of these Boring and Turning Mills include twelve changes of speed and six changes of feed, controllable from either side of the machine; spiral bevel and spur reduction gears driving the work table; pendant control of rams and cross slides; and rapid power traverse with independent control of the two heads.

*Please write for fully illustrated brochure.*



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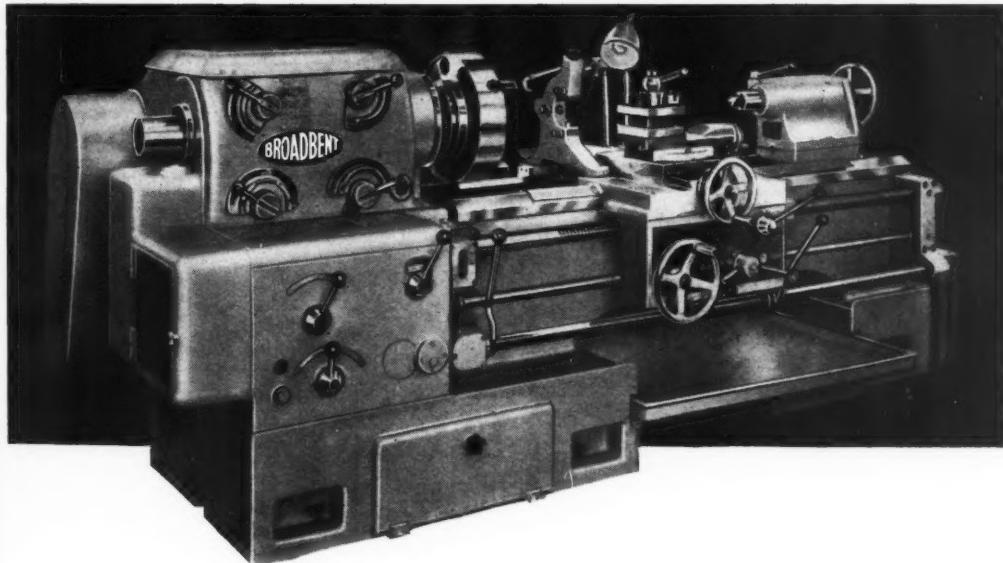


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Broadway HME

# MORE output per man-hour with

Good men plus good tools equal good output. Every Broadbent lathe incorporates almost a century of machine tool building. Manufacturers know that for versatility, accuracy and reliability there is nothing quite as good as a Broadbent Machine Tool.



This 18/22" Swing Heavy Duty Centre Lathe of modern design is a typical example of the Broadbent range. It has a 15 h.p. drive motor and spindle speeds up to 1,000 r.p.m.

The Broadbent range of Machine Tools includes Surfacing and Screw-cutting Lathes from 17" to 72" swing, Surfacing and Boring Lathes, Break Lathes, Crankshaft Lathes and vertical Turning and Boring Mills with 5', 6', 8' or 10' capacity.



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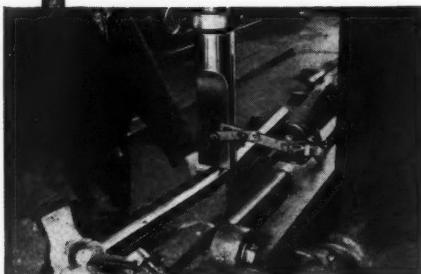


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## STRAIGHTENING PRESSES

O & S Straightening Presses, made in 5 sizes with capacities ranging from 4 to 60 tons pressure, have for many years been the first choice of engineering firms throughout the world, including most of the leading motor manufacturers. For speed, accuracy and ease of operation, O & S Straightening Presses are in a class of their own.



*In the Leicester works of Frederick Parker Ltd., O & S Straightening Presses are in daily service ensuring that steel shafts are perfectly straight and true.*

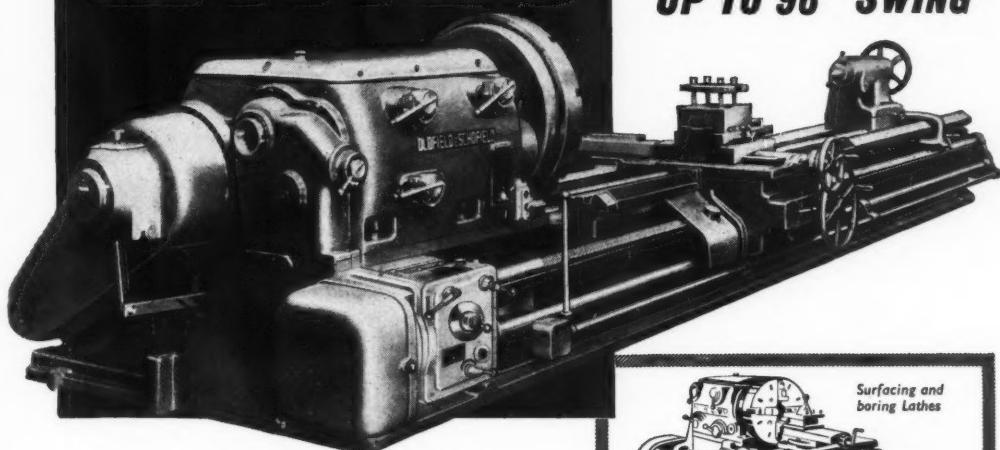


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BOOTHTEW, HALIFAX, YORKSHIRE



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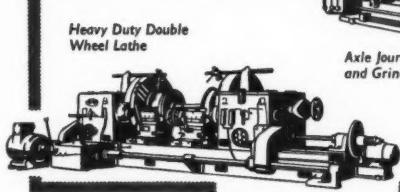
# Heavy Duty LATHES



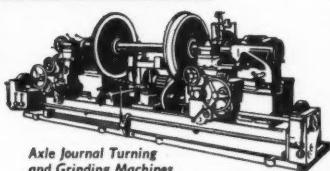
18½" Centre 'D' Type Lathes. Built in sizes up to 48" swing.



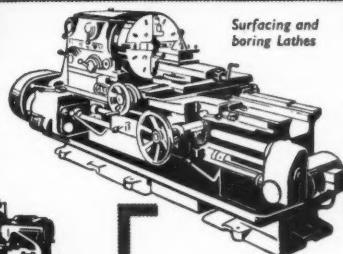
**UP TO 96" SWING**



Heavy Duty Double Wheel Lathe



Axle Journal Turning and Grinding Machines



Surfacing and boring Lathes

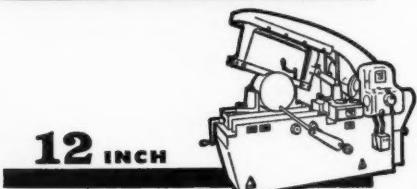
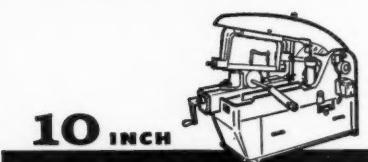
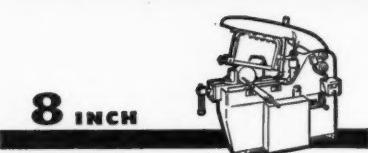
O & S have for many years manufactured a wide variety of heavy lathes which have earned for the company a fine reputation for precision engineering and first class craftsmanship. The range includes Surfacing and Boring Lathes up to 96" swing, Brake Lathes, Axle Lathes, railway carriage and wagon wheel lathes, axle journal turning and burnishing lathes etc., all embodying the latest developments in modern lathe design.



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**QUALTERS & SMITH BROS. LTD**  
BARNESLEY, YORKSHIRE

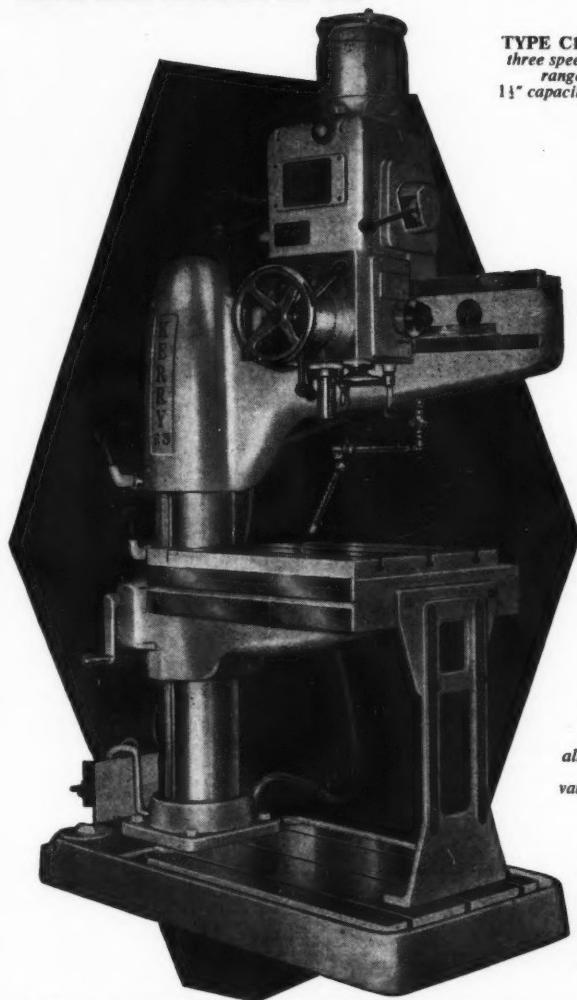


Sales Office: WARTON ROAD, STRATFORD, LONDON, E.15. Telephone: MARYland 6811

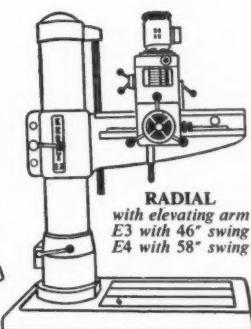
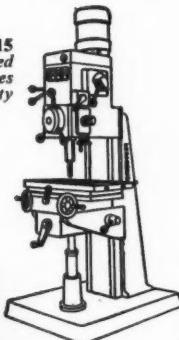
Broadway/Q58

# KERRY

## RANGE OF DRILLING MACHINES



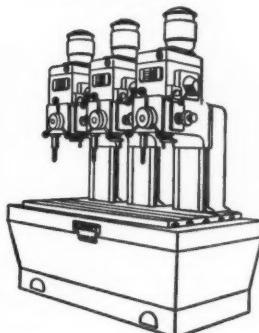
**TYPE C15**  
*three speed ranges  
1½" capacity*



**RADIAL**  
*with elevating arm  
E3 with 46° swing  
E4 with 58° swing*



**TYPE 150 AG**  
*all geared head also  
150 IV infinitely  
variable 1½" capacity*



**MULTI-HEAD**  
**MS 3**  
*line production  
unit 1½" capacity*

Full details from your Machine Tool Merchant or our Sales Office

The Radial Drill illustrated on the left is available in 2 models. The R3 has a swing of 36°, the R4, 48°. Both models have a capacity of 1½" in steel and 1½" in cast iron, 9 spindle speeds ranging from 90 to 1120 r.p.m., quick hand traverse, fine hand feed and three rates of power feed. The Kerry range of drilling machines includes bench, pillar and line production models with drilling capacities from ½" to 1½".



manufactured within the KERRY GROUP by  
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BARNSTABLE, YORKSHIRE



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Broadway Q511

# KERRY

## PILLAR DRILLS

These machines are renowned for their high standard of performance and dependability under the most arduous operating conditions to be found in industry today. Modestly priced, sturdily built and extremely versatile, they will give years of trouble-free service.

### KERRY '100' POWER FEED PILLAR DRILL

A 1 inch capacity machine with nine speeds ranging from 70-1,500 r.p.m., a lever operated gear change with totally enclosed gear box and power feed, available with either a square or circular table.



### KERRY '125' PILLAR DRILL

A 1½ inch capacity, all-gearred head machine, giving nine spindle speeds from 70-1,500 r.p.m. or 48-985 r.p.m., 3 rates of power feed reverse to spindle for tapping.

**KERRY'S**

manufactured within the KERRY GROUP by  
**KERRY'S (Engineering) CO. LTD**  
 GRANGE ROAD, LEYTON, LONDON, E.10



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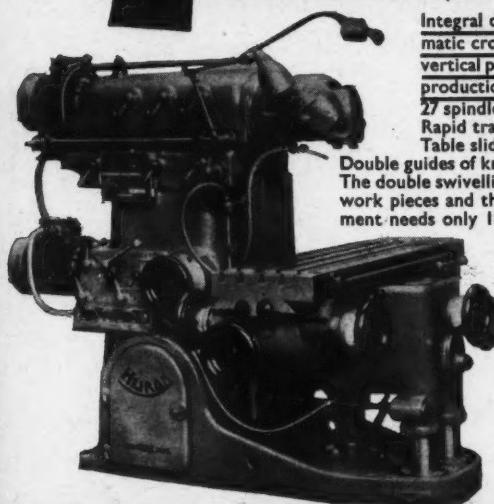
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ART

5611



SLIDING RAM  
GIVES 27½ in.  
AUTO CROSS  
FEED



## HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

### HURON SUPER UNIVERSAL MILLERS

Integral double swivelling universal head provided with 27½ in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from  $\frac{1}{8}$  in. to 30 in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel. Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14 in. to enter work pieces and the whole sliding ram with its 27½ in. automatic cross movement needs only 18 in. clearance. OPTIONAL EXTRA FEATURES: Mounted spacing casting assemblies providing additional 8 in. capacity under spindle. 26 in. wide 8 T-slot tables and 39 in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds		
		Long	Cross	Vert.
KU4	56½ in. x 15½ in.	43½ in.	27½ in.	19½ in.
KU5	64½ in. x 15½ in.	51½ in.	27½ in.	19½ in.
KU6	78½ in. x 16½ in.	59 in.	27½ in.	19½ in.
KU55	64½ in. x 26 in.	51½ in.	38½ in.	18½ in.
L83	157 in. x 59 in.	118 in.	39 in.	59 in.

#### HURON MU.6/FERRANTI 3-D MILLER

Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slides full length of base table and the sliding ram moves vertically and horizontally.

**DUFOUR**  
UNIVERSAL  
MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING  
HEAD, RETRACTABLE SLIDE BRACKET AND  
SPACING CASTING GIVING 26 DAYLIGHT  
ON NO. 59 AND 21 ON NO. 61

FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½ in. Spacing Casting Drive assembly on 59 Machine 26 in. daylight, and 21 in. on No. 61.

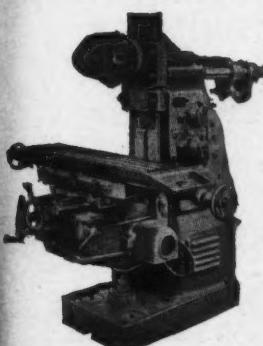
MODELS 53 & 61. 16 universal head spindle speeds.

21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ½-18½ in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 21-1180 r.p.m.; 16 automatic feeds ½-20 in.

MODEL 54. Automatic cross feed of

universal head 20 in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ½-23½ in.

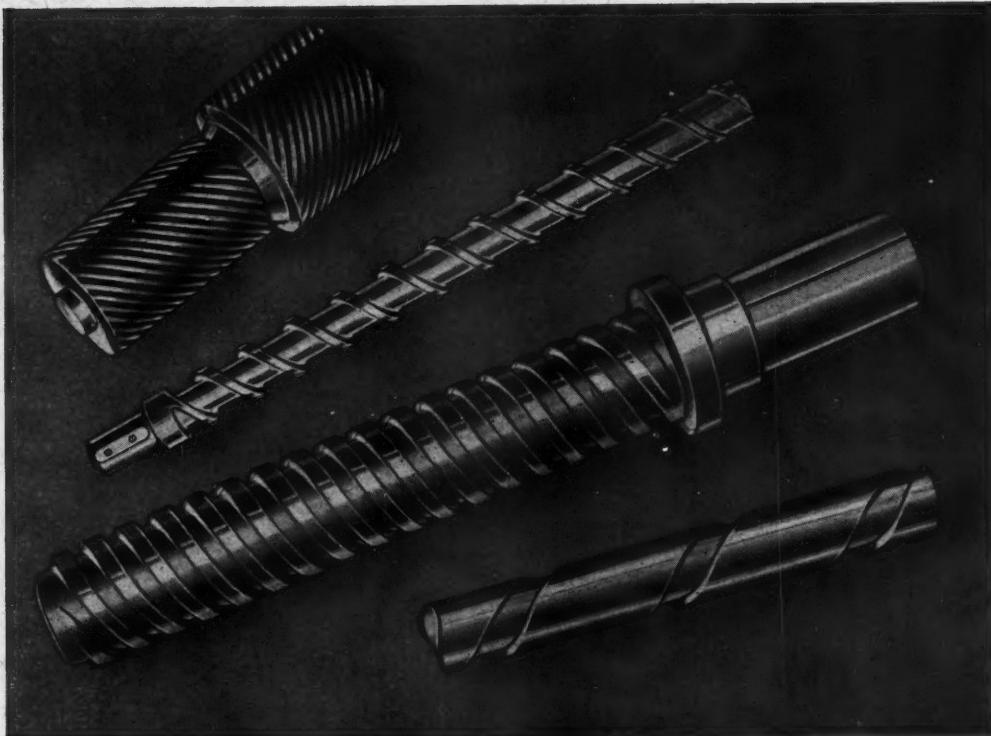


Send for full particulars of our very extensive range of these machines; ask for demonstration.

**Rudolph Carne & Co. Ltd.**

SWAN WORKS, FISHERS LANE,  
CHISWICK, LONDON, W.4.

Tel. CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON, W.4.



# KINGSTON

**ACTUAL MANUFACTURERS OF PRECISION TRANSMISSION  
SCREW THREADS (½" dia. to 10" dia. : up to 30' long according to dia.) AND NUTS  
—ALSO EXTRUDER SCREWS FOR THE PLASTICS INDUSTRY**

*The following information will be of assistance when making enquiries:—*

**TYPE OF THREAD**

**HAND OF THREAD**

**PITCH (P)**

**LEAD (L)**

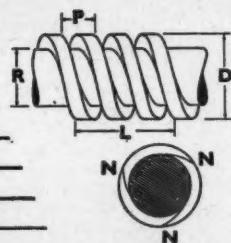
**No. OF STARTS (N)**

**OUTSIDE DIAMETER (D)**

**ROOT DIAMETER (R)**

**TYPE OF MATERIAL**

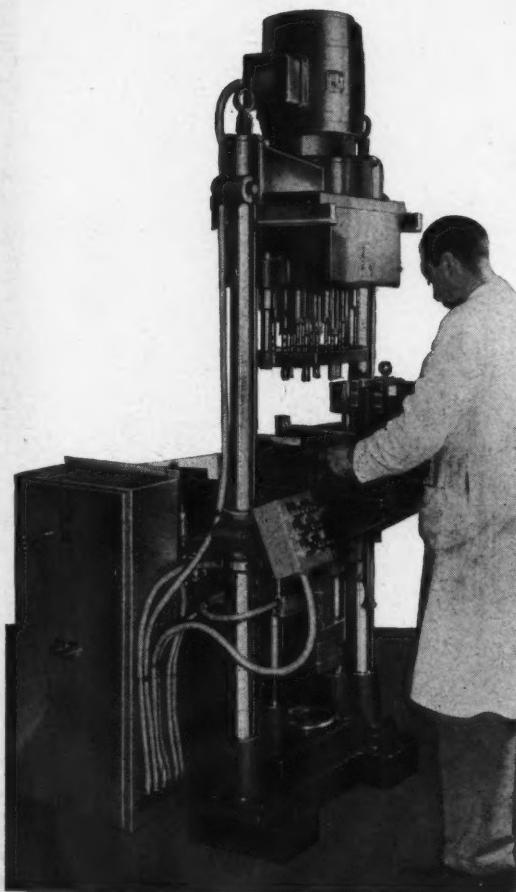
**PURPOSE**



**KINGSTON ENGINEERING COMPANY LTD.** DANSOM LANE • HULL • YORKSHIRE  
Tel. 31676 (4 lines) Grams: "Kingston 31676 Hull"

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**W.J.  
MEDDINGS  
LTD.**



*Write for full particulars to :*

**W. J. MEDDINGS LTD**

IPSWICH ROAD • TRADING ESTATE • SLOUGH • BUCKS  
Telephone: Slough 26761 (5 lines)

SHIRE  
76 Hull"

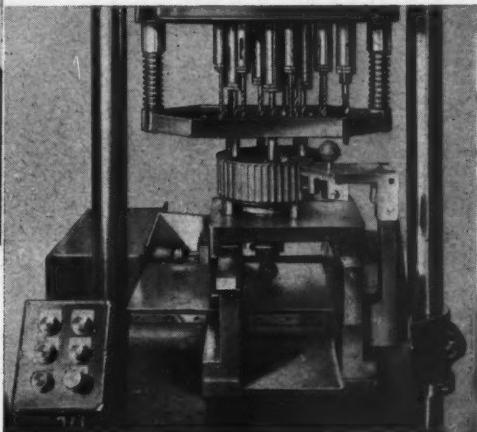
# Hydraulic Multi-spindle drilling machines

These hydraulic up-stroking multi-spindle drilling machines provide fast approach, accurately controlled drilling feed and fast return of the worktable after completion of drilling. They are extremely flexible in use and can be fitted with driving motors of up to 15 h.p.—the thrust available from standard machines can be varied up to 8,000 lbs.

The machine illustrated is one of two recently supplied to a customer for the quantity production of Brake components. Provision is made for fast changeover of multi-spindle Heads and tooling, and the machines were supplied complete with all necessary jigs and fixtures built to customer's requirements.

'Patterning' of multi-spindles enables one machine to cater for a number of different parts—Heads with up to 90 spindles are in course of production.

A complete range of fixed centre and adjustable type multi-spindle Heads for attachment to existing machines, together with a comprehensive tooling service are also available.



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*Another*  
**TWO-WAY DRILLING MACHINE**

by

**AMT**

*incorporating*

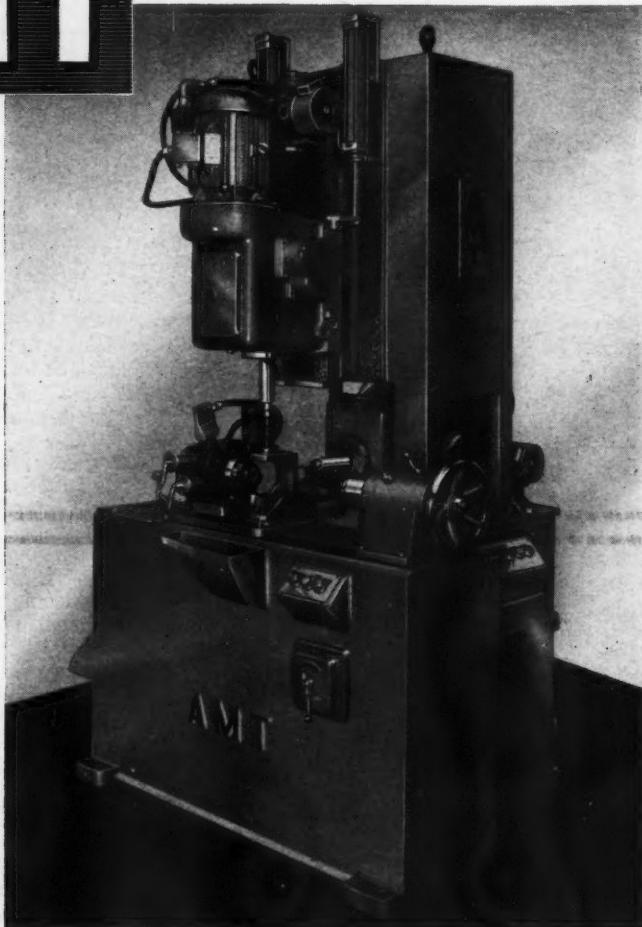
**2 AMT/DI**  
 2 h.p. UNIT HEADS

Fully automatic  
 cycle giving 10  
 indexes, drilling  
 20 holes.

Machine recently  
 installed at  
**THE BRITISH PISTON RING  
 CO. LTD., COVENTRY** by  
 whose kind permission  
 this photograph  
 is reproduced.

*Operation:*

20- $\frac{1}{2}$ " dia. holes  
 Cycle time 2½ minutes.



The range of AMT Drilling Heads comprises four sizes from 2 to 20 h.p. Brochure and full specifications will gladly be supplied on application.

**A·M·T (B'HAM) LTD.** BOURN BROOK, BIRMINGHAM 29  
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**DE LAVAL**

# **TURBO MATIC**

**FOR THE MOST  
EFFICIENT  
CLARIFICATION  
OF GRINDING  
AND HONING  
COOLANTS**

By the continuous removal of solids, De Laval Turbo-Matic Clarifiers ensure a coolant clarity unattainable by any other method.

The extracted solids, held in the large capacity bowl, are discharged automatically at pre-determined intervals.

De Laval Turbo-Matic Clarifiers can be used for individual requirements, or coupled up as a centralized installation.

*Write now for fully descriptive literature  
FACTORY EQUIPMENT DIVISION*

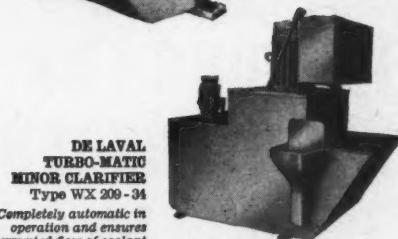
**ALFA-LAVAL  
COMPANY LIMITED**

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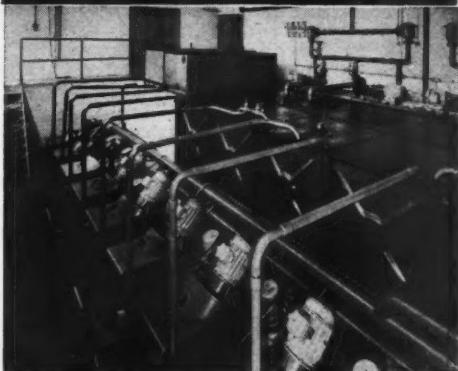
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**DE LAVAL  
TURBO-MATIC CLARIFIER  
Type BX 215-348**



**DE LAVAL  
TURBO-MATIC  
MINOR CLARIFIER  
Type WX 208-34**  
*Completely automatic in  
operation and ensures  
uninterrupted flow of coolant*

NINE TURBO-MATIC clarifiers, automatically controlled by a timing device, installed by a large British bearing manufacturer for the centralized treatment of mineral oil.





## ESSENTIAL READING FOR EVERY MODERN ENGINEER

From the manufacturers of ROCOL  
MOLYBDENISED LUBRICANTS—a new  
publication which brings you up to  
date on the uses of Rocol Anti-Scuffing Products  
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Brief, factual and complete.

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**RAVENSBURG****Facing Copy Lathes****MODELS****KH 45  
and 55**

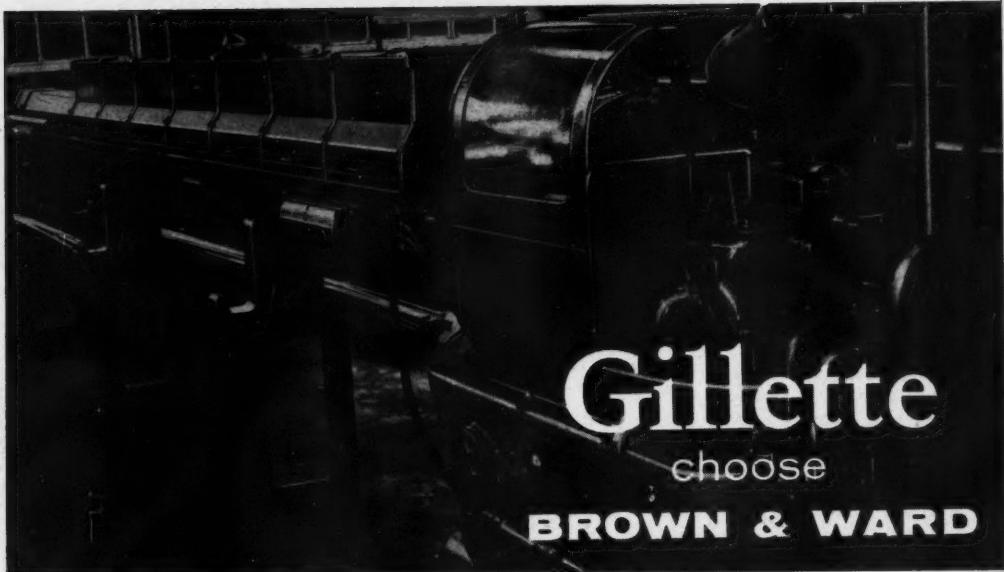
With the UNICOP electronic-hydraulic two co-ordinate copying system for machining deep and difficult profiles. The headstock and carriage are mounted on a common bed with two vee-slides on which both can be traversed. A single button on the pendant control panel sets the machine for use as a normal facing lathe without copying. Available with infinitely variable spindle speeds and constant cutting speed control: Maximum turning diameter up to 55 inches.

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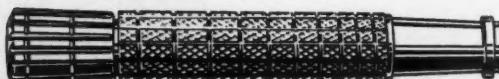


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choose  
**BROWN & WARD**

## AUTOMATIC BAR FEEDS

To boost the production of component parts for their products to meet an ever-increasing demand, Gillette Razor Company have equipped this battery of Index Automatic Machines with BROWN & WARD AUTOMATIC MAGAZINE BAR FEEDS. Substantial increases have now been obtained, justifying beyond all doubt the confidence that Gillette placed in this equipment which is designed and manufactured to ensure reliability and maximum productive efficiency.

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**Automatic Bar Machines and Magazine Bar Feeders**

**BROWN & WARD (TOOLS) LTD.**

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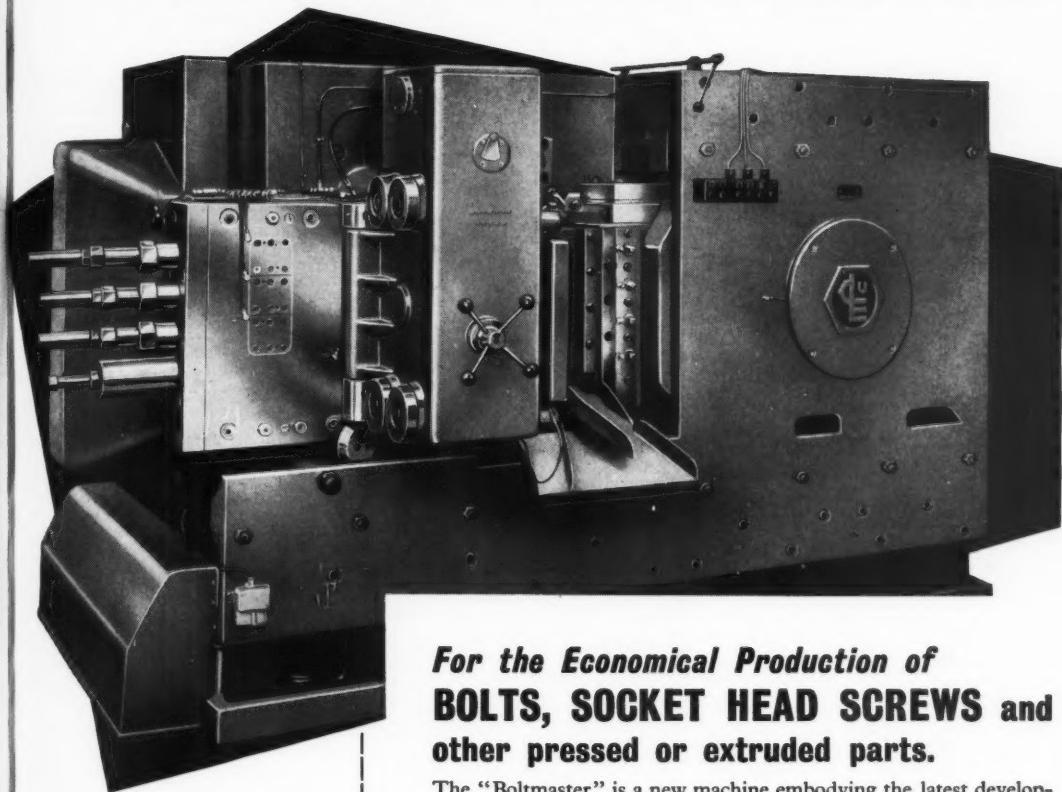
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**PELTZER & EHLERS**

# 'BOLTMMASTER'

## COLD EXTRUSION TRANSFER PRESS



**HIGH OUTPUT**

**LOW SET-UP  
TIME**

*For the Economical Production of  
BOLTS, SOCKET HEAD SCREWS and  
other pressed or extruded parts.*

The "Boltmaster" is a new machine embodying the latest developments in cold-forming techniques. It will pay you to investigate the possibilities of this machine.

Type	Capacity	Output/min
GB 75	up to $\frac{3}{8}$ inch	120—140
GB 100	up to $\frac{1}{2}$ inch	70—100
GB 200	up to $\frac{3}{8}$ inch	60—90
GB 300	up to 1 inch	50—80

*For further particulars write or telephone TODAY*

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MACHINE TOOL CO. LTD.

WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

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**MATRIX**  
**QUALITY**

**GEAR  
GRINDING  
MACHINE**

NO. 61-6-9

Manufactured by Coventry  
Gauge & Tool Co. Ltd.

- Gears can be ground from solid hardened blanks overcoming heat treatment distortion problems.
- Gears of suitable dimensions can be mounted in multiples and ground in one operation.
- Generating principle eliminates indexing.
- Gear tooth development is from the basic rack which is formed on the grinding wheel periphery in a continuous helix.
- Any diameter gears of similar pitch can be ground merely by altering the change gears for the number of teeth.
- Built-in wheel crushing unit is semi-automatic, type of pitch being governed by three easily fitted racks and segments.
- For gears of extreme precision, grinding wheel is diamond dressed by unit which is quickly interchanged with crusher.

**Study these PRODUCTION TIMES!**



**4½ mins.**  
40 D.P. 120 Teeth.  
3" P.C.D.



**12 secs. each**  
15 gears ground  
simultaneously  
1.20 Module 40 Teeth.  
48 mm. P.C.D.



**2½ mins.**  
48 D.P.  
24 Teeth.  
0.5" P.C.D.

# **GRIND**

## **YOUR SMALL SPUR GEARS**

### **better and faster than by cutting**



**S P E C I F I C A T I O N**

Max. diameter admitted	6"
Max. length between Centres	9"
Max. length of Teeth Ground	3"
Min. Number of Teeth Ground	12
Maximum Pitch	16 D.P. (Module 1.6)
Minimum Pitch	200 D.P. (Module .125)

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(rule 1.6)

D.P.

(rule -12<sup>e</sup>)

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D.P.

Teeth.

C.D.

E 0033

E 2022

No

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# Spectra color

Engineers' layout fluid in transparent blue, now in handy aerosols

- ★ Cannot spill or evaporate
- ★ Cuts out brushes and pots
- ★ Gives a thin, durable film of solid, even colour
- ★ Dries instantly—reduces waiting time
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- ★ Resists petrol, water and most oils
- ★ Easily removed with Spectra Remover

Now in handy aerosol form and even easier to use, Spectra Spray leaves a blue film which speeds marking off to very fine limits—gives greater accuracy in machining with less eye strain and lower incidence of scrap.

Each operator needing Spectra Color can now be supplied with an individual can, avoiding time loss in collecting and returning to stores.

## MAKE A BLUE-PRINT ON METAL FROM A BLUE-PRINT

### Spectra *Cellulose* Spray Paints

For the small spray job on prototypes, models, machinery, mock-ups, "one-offs" etc.

- ★ Available for instant use
- ★ Saves maintenance of spray guns for small jobs
- ★ Dries rapidly and evenly without brush marks
- ★ Fine mist delivery reaches inaccessible parts
- ★ Special non-clogging spray head—avoids tearing
- ★ Available in 14 colours and primer

These handy spray cans are so easy to use—each coat is dry in a few minutes—reducing waiting time for additional coats.

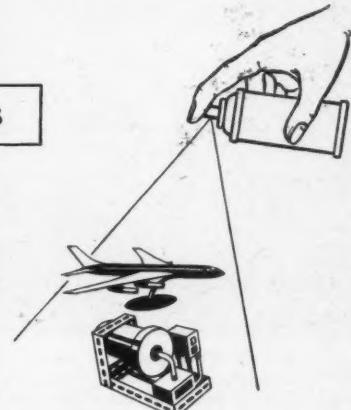
**APPLICATIONS** For spray painting of jigs, models, prototypes, radiators, small repair jobs, stencilling crates, part numbers—rapid colour coding—finishing display work, etc.

**SPECTRA CHEMICALS LIMITED,**  
31 High St, Caterham, Surrey. Caterham 4231



In Transparent Blue only (6 fl. ozs.)  
Part No. SS1, 7/6 each. Carton lots of 12, 7/- each. 36 and above—carriage free.

Also available in other sizes and colours for brush application—write for details.



## COLOURS AND PART NOS.

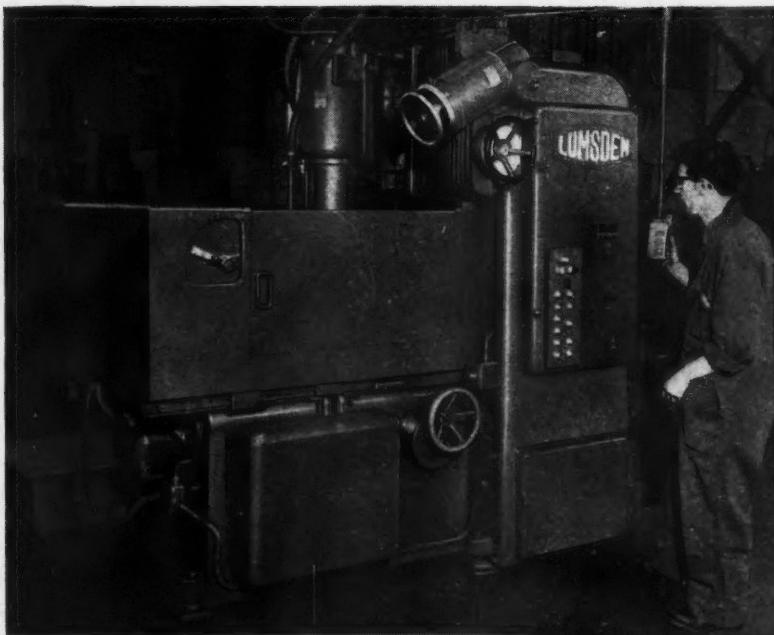
Red	PR	Dark Green	PT
Yellow	PY	Light Blue	PK
Fawn	PF	Dark Blue	PL
Brown	PB	Gold	PG
Light Grey	PD	Silver	PS
Dark Grey	PE	White	PW
Light Green	PI	Black	PZ
Primer	PP		

in 6 fl. oz. aerosols at 9/6 each. Cartons of six (colours to choice), 9/- each.

# For high precision die & tool grinding

LUMSDEN MODEL 230

## SURFACE GRINDERS

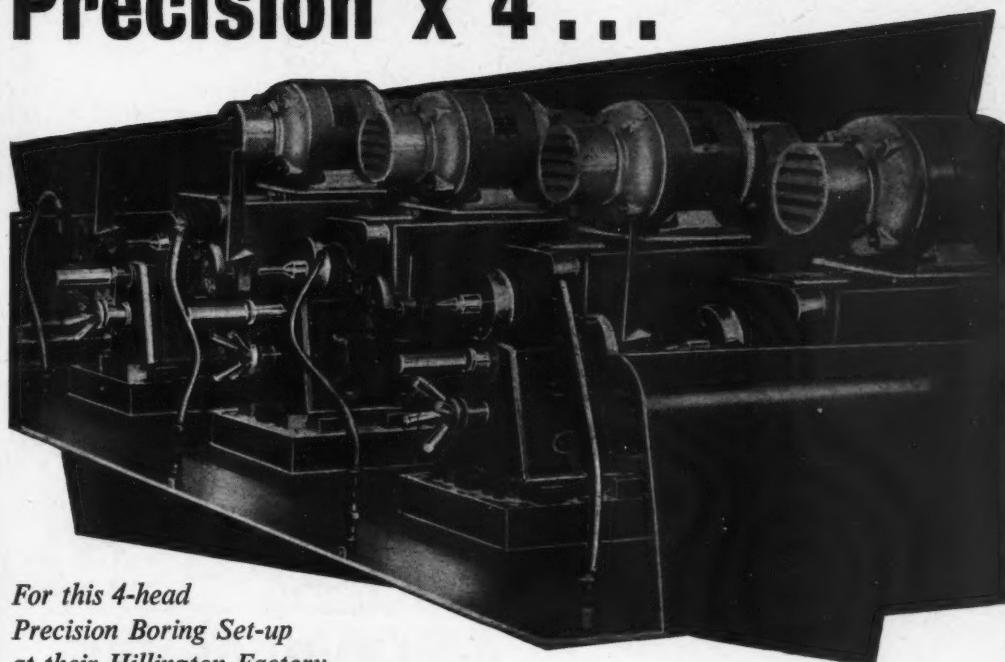


A wide range of dies and tools are ground to very fine limits on LUMSDEN Model 230 surface grinders at both the Wellington and Bilston works of Joseph Sankey & Sons Ltd. These piano-type machines with their rotary table and wide variety of hand and power operated movements, incorporate a hydraulically operated saddle and shockless reversal, enabling the finest finishes to be obtained. Furthermore, fine hand movements of the head permit grinding close to a shoulder or die pin. Standard machines are supplied with either 30" or 48" diameter tables. Larger and special table sizes to customer's requirements. There is a complete range of Lumsden Surface Grinders from which to choose a machine ideally suited to your needs . . . Write for full details to

Manufacturers:  
**LUMSDEN MACHINE CO. LTD., GATESHEAD**  
Sole Distributing Agents:  
**ALFRED HERBERT LTD., COVENTRY**

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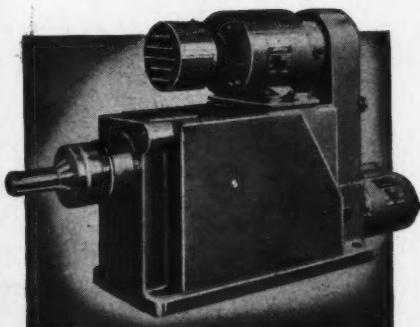
# Precision x 4 . . .



*For this 4-head  
Precision Boring Set-up  
at their Hillington Factory*

**ROLLS-ROYCE** *selected*

## H.P.E Fine Boring Unit Heads



May we help with your Fine Boring problems?  
We offer a range of standard heads and base units  
together with a technical design service for special  
machines.



*An Associated Engineering Limited Company*

**HIGH PRECISION EQUIPMENT LTD • Bletchley • Bucks • Tel. Bletchley 3403/4/5**

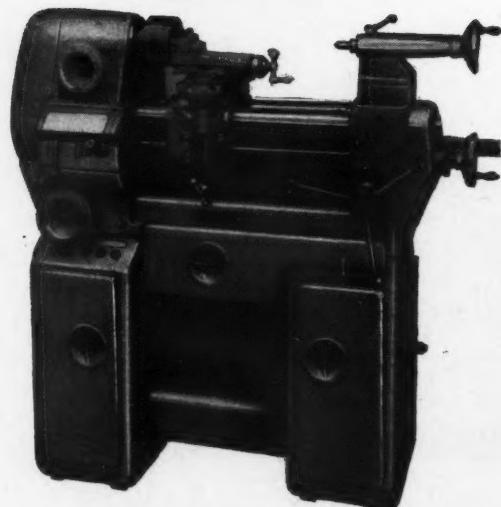
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Redditch**

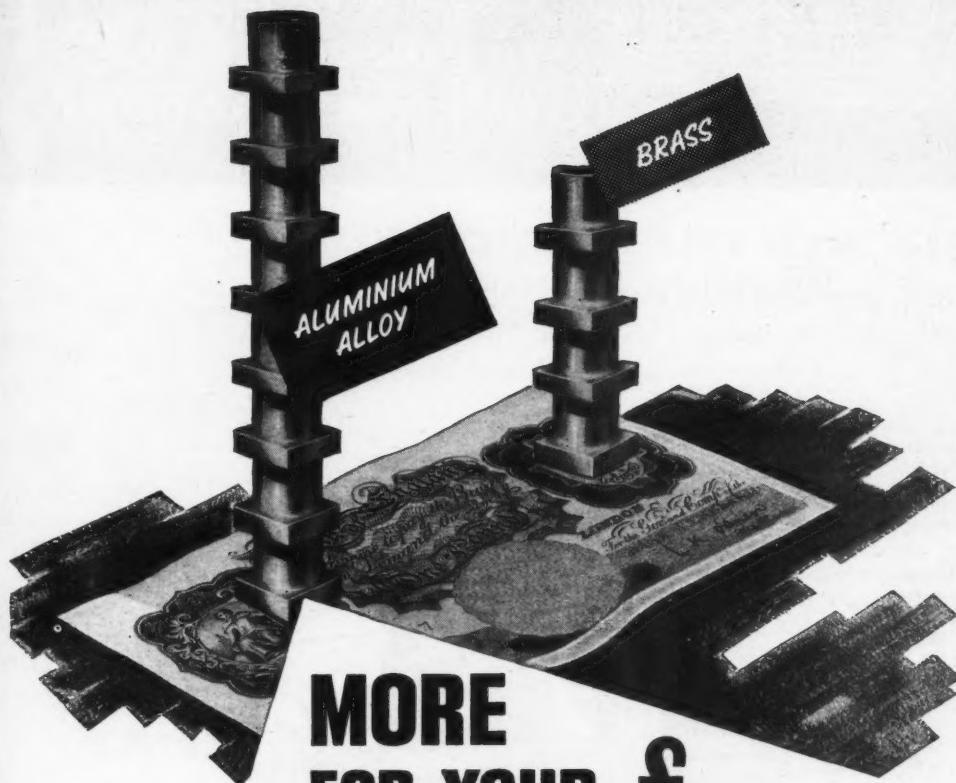
# **KNELLER** **MULTI-PURPOSE** **LATHES**

Although termed lathe, this versatile machine has additional characteristics such as the tailstock unit can be traversed by hand or mechanically with a range of feeds. A vertical movement to the saddle table providing characteristics of a horizontal boring machine, with thread cutting facilities. A facing slide is supplied to perform this operation. This machine is an essential for toolrooms and research departments, where pre-production and small quantities of accurate and intricate machining are required. Also being used in Technical Colleges for educational purposes.



**KNELLER (Instruments & Tools) LTD., LONDON ROAD, DAVENTRY Tel: DAVENTRY 446**

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## MORE FOR YOUR £

Material cost per item is less than that of other non ferrous metals.

Clean modern appearance.

Can be anodised—clear or colour.

Automatics can operate at maximum feeds and speeds.

Small chips eliminate swarf "build up" at tool tip.

*Write TODAY for Full Technical Details.*

*Specify*  
**ALMINAL**  
**152**

**ALUMINIUM ALLOY  
FREE MACHINING BAR**

# Southern Forge LTD

MEADFIELD ROAD • LANGLEY • BUCKS

Telephone: LANGLEY 301

**ALUMINIUM AND ALUMINIUM ALLOY  
EXTRUSIONS TUBES AND FORGINGS**

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**KEARNEY & TRECKER**  
**MILWAUKEE**

Registered Trade Mark in Great Britain.

## BED TYPE production milling machine

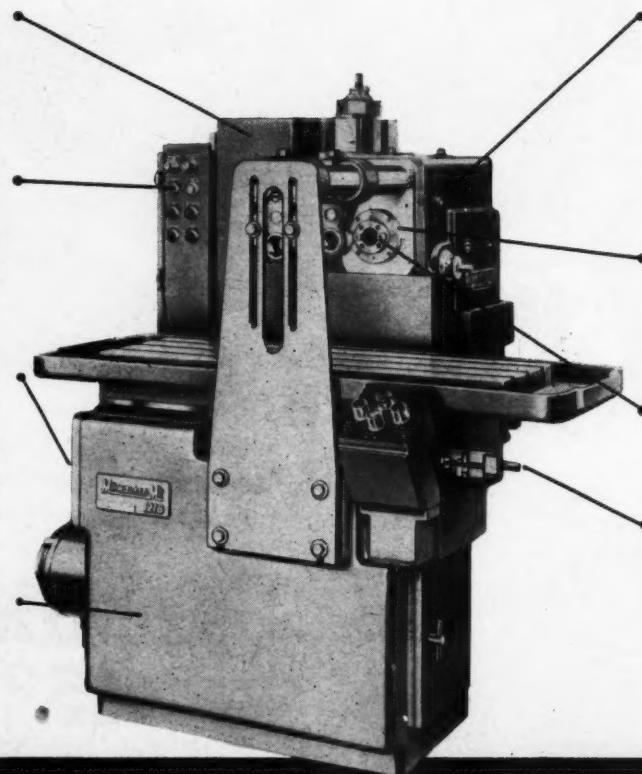
Designed for fast, accurate, profitable  
production of small to medium size parts.

**UPRIGHT**—rigid  
one-piece construction...heavily ribbed  
to absorb vibration  
and torsional stresses  
imposed by high rates  
of metal removal.

**POWER CON-**  
**TROL STATION**  
—conveniently located,  
compact grouping of  
switches which in-  
clude master, spindle,  
table and coolant  
control.

**TABLE FEED**  
**DRIVE**—self-contained  
gear driven unit...  
quiet, positive power  
transmission. Individ-  
ual quick-action  
magnetic clutches  
control feed, rapid  
traverse and table  
direction.

**BED**—multiple box-  
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heavily ribbed through-  
out at all stress points  
to absorb the heaviest  
cutting forces...Integ-  
rally cast "square-  
wrap" table ways.



**SPINDLE-HEAD**  
—rugged compact de-  
sign...micrometer  
dial, graduated to  
.001", facilitates ac-  
curate manual posi-  
tioning...12" vertical  
range...double clamp-  
ing assures rigid,  
positive settings.

**SPINDLE QUIL**  
—three inches of  
cross-adjustment...  
quick, positive clamp-  
ing.

**SPINDLE**—No. 40  
N.S. taper...three-  
bearing spindle.

**TABLE SCREW**  
—has 126,000 p.s.i.  
tensile strength and a  
yield point of 100,000  
p.s.i....more than  
ample to move the load  
easily without distor-  
tion.

Choice of three horsepower and speed ranges available—2 h.p., 25-750 r.p.m.; 3 h.p., 50-1500 r.p.m.; 5 h.p., 100-3000 r.p.m.—independent  $1\frac{1}{2}$  h.p. feed motor—choice of three feed rate ranges— $\frac{1}{2}$  to 20 i.p.m.; 1-40 i.p.m.;  $1\frac{1}{2}$ -60 i.p.m. horizontal feed range 18 inches - vertical feed range 12 inches.

**Milwaukee Mil**  
Model **I218**

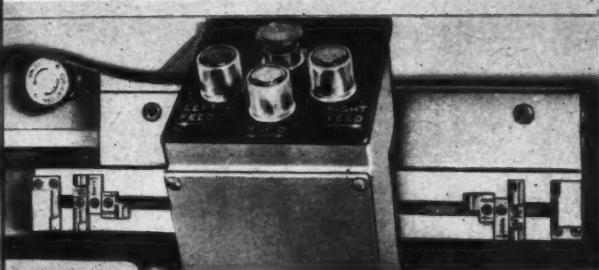
for SMALL, MEDIUM LOT  
and CONTINUOUS *Production*

## CUTS SET-UP TIME

### CENTRAL CONTROL GROUPING

An outstanding example of operating convenience. A "twist of the wrist" effectively eliminates backlash for either conventional or climb milling. The compactly grouped push-button Operator Control Station facilitates control of all table movements.

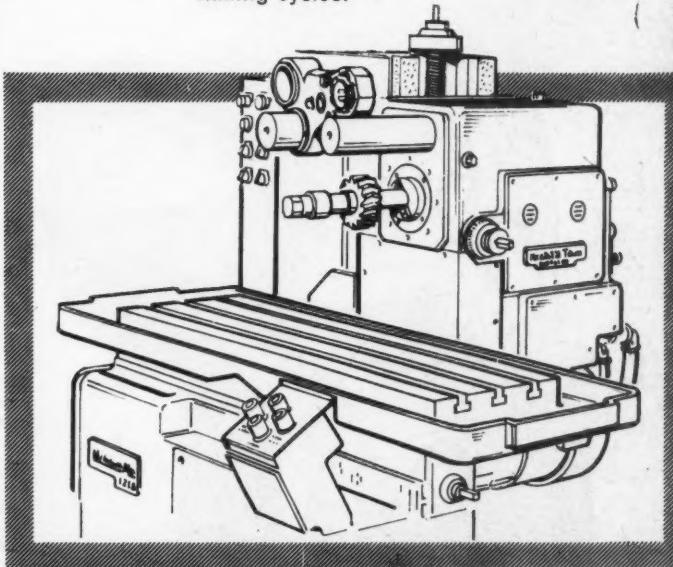
Either manual or automatic cycle. Automatic cycle table control is based on an electrically coded system, with a minimum of basic styles of trip dogs, to create a wide range of automatic milling cycles.



### EASE OF ACCESS

#### ... TO CUTTERS AND ARBORS

Cutters and arbors can be changed WITHOUT removing arbor supports from overarms. Merely extend one overarm, slide arbor support forward on extended overarm, swing it up, move it back and rest it on the other overarm.



*Manufactured and Distributed by ...*

**KEARNEY & TRECKER - C.V.A LTD.**

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**ACBARS** for Swiss precision machines

## PERRIN AV2 JIG BORER

WITH OPTICAL TABLE

automatic positioning available

Boring capacity in cast iron 4in.

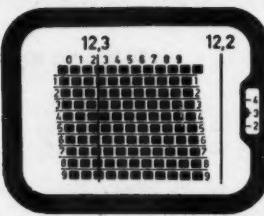
Table size 19 $\frac{5}{8}$ in.  $\times$  11in.

Longitudinal movement 16in.

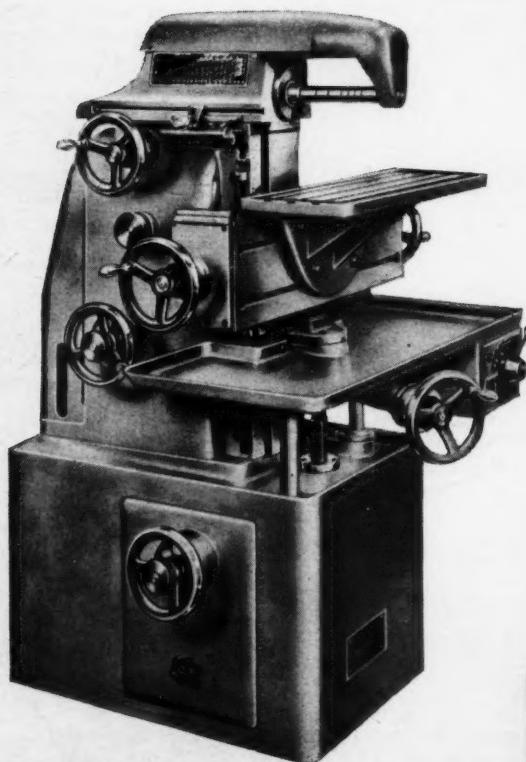
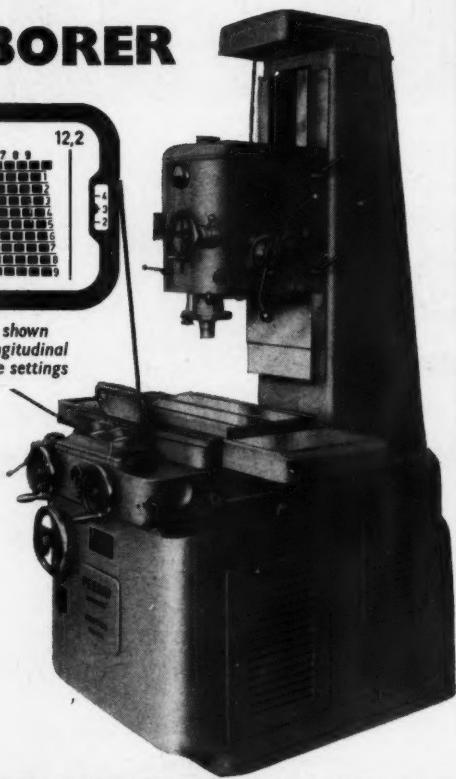
Transverse movement 11in.

Max. distance spindle to table 18 $\frac{1}{2}$ in.

Infinitely variable spindle speeds from 60—3200 r.p.m. with power feed to spindle.



Two scales as shown  
controlling longitudinal  
and transverse settings



## CHRISTEN UO-A

### UNIVERSAL MILLING MACHINE

with Table swivelling in 3 planes  
FOR HORIZONTAL & VERTICAL MILLING

Especially suitable for toolmaking and for high precision repetition work.

Infinitely variable speeds and feeds.

Longitudinal and vertical power feed to table.

Table size 26 $\frac{3}{8}$ in.  $\times$  9in.

Large range of attachments available including vertical milling head, slotting attachment, universal dividing head, rack milling attachment, measuring equipment with slip gauges and dial indicators.

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on the Veraloy principle perform  
better and cost less to buy and to regrind.  
*Write for particulars to :*

**VERALOY**

**VERALOY PRODUCTS LTD.**

BEECH ROAD · THE MARSH · HIGH WYCOMBE · BUCKINGHAMSHIRE  
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## what's in your tooling?

$\frac{31}{32}$ " dia. SPEEDICUT "CHIPBREAKER" Drill on black steel plate 2" thick at a speed of 110 ft. per minute with .020" feed. Previously the best conditions were, speed 80/90 ft. feed .010"—the "Chipbreaker" drill has reduced drilling time by half.

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TOOLS

FIRTH BROWN TOOLS LIMITED  
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**PROFITS OR PROBLEMS • PROFITS OR PROBLEMS**

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# In*g*uture

**...URIS OR PROBLEMS PROFIT**

PROBLEMS OR PROFITS PROFITS OR PROBLEMS

## **PROFITS OR PROBLEMS PROBLEMS**

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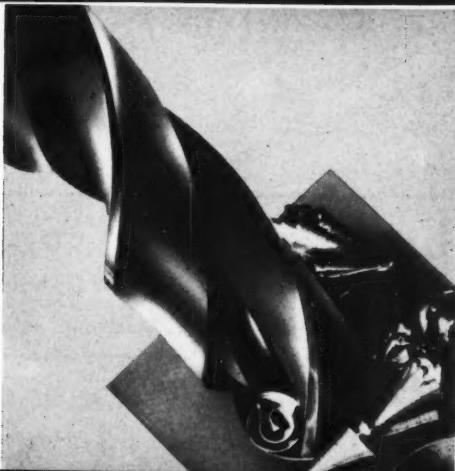
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# BREAKER

*for*

## *production*



*Finishing to micro-inches R.M.S.  
superlatively fast on tools and  
components*



*... demands*

**VANDIA**  
METAL AND RESIN BONDED  
**DIAMOND WHEELS**  
and **HAND LAPS**

AVAILABLE IN A FULL RANGE  
OF SHAPES AND SIZES

UNSURPASSED IN QUALITY AND  
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## The new LAKE ERIE form-all

WILL PRODUCE A WIDE VARIETY OF BENDS IN  
SHEET AND PLATE **WITHOUT DIES IN "IMPOSSIBLE"**  
ONE-PIECE SHAPES.



Model 216 HH Form-all—  
Rated at 24in. of 16 gauge  
mild steel—hand operated clamp and wings—hand adjustment of hold-down and wings. Other models available in this type up to 72in. by 18g.

- Turns out intricate shapes . . quickly . . accurately . . without tooling.
- Does angle or radius bending.
- Perfect for prototype work, samples and short or long runs.

HYDRAULIC AND AIR-POWERED MODELS ARE ALSO AVAILABLE



MODEL 618 CHL



MODEL 1037 MMP

FOR FULL DETAILS OF THESE MACHINES — WRITE

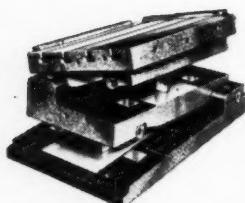
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Sole Agents in British Isles for Lake Erie Machinery Corp., Buffalo,  
N.Y. U.S.A.

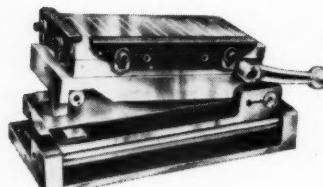
MACHINE TOOL DIVISION  
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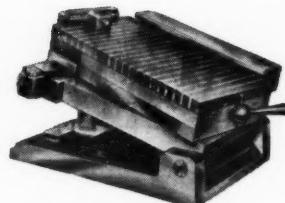




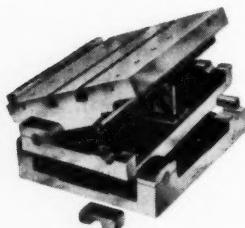
Compound Sine Table with 'T'  
Slotted Face: 12in. by 8in.



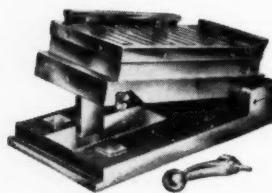
Compound Sine Table with Non-  
Electric Magnetic Face: 10in. by 5in.



Produced for Grinding Turbine  
Blades, Tilting and Swivelling with  
14in. by 8in. Non-Electric Magnetic  
Chuck.



Special for Aircraft Industry, 'Com-  
pletely Universal': 12in. by 10in.



Simple Angle Sine Table with Non-  
Electric Magnetic Face: 10in. by 5in.



Simple Angle Sine Table with Tapped  
Holes for Clamping: 6in. by 4in.

A  
SELECTION  
OF  
**COMPOSINE  
SINE TABLES**

FROM THE COMPREHENSIVE  
WINDLEY

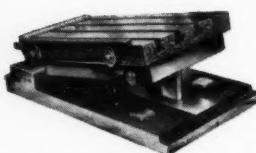


RANGE

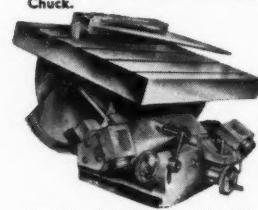
Centres for most standard types can  
be supplied at extra cost.

Manufactured In England by

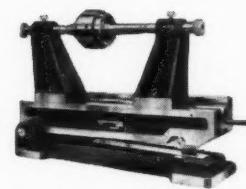
**WINDLEY BROS  
LIMITED**



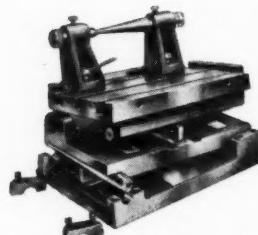
Simple Angle Sine Table with 'T'  
Slotted Face: 12in. by 8in.



Special Compound with Super  
Accurate Scales and Optical Pro-  
jection Micrometers.



Sine Centres, with or without  
extended base, surfaced parallel to  
the centre axis when at rest.



Universal Compound Sine Table with  
'T' Slotted Face: 11in. by 7in.



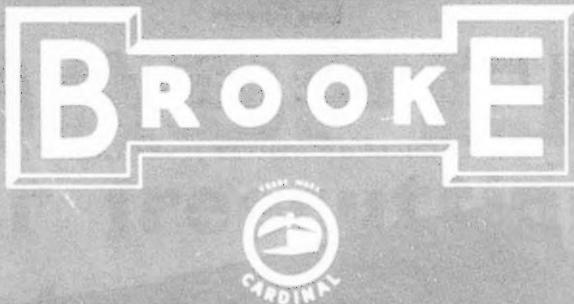
Universal Compound Sine Table with  
Non-Electric Magnetic Chuck: 12in.  
by 8in.

**CROWN WORKS • LONDON RD • CHELMSFORD • ESSEX • Chelmsford 2224**

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# CARBIDE "ADJUSTABLE" REAMERS

HAVE EXCEPTIONALLY LONG LIFE

THEY CAN BE RE-GROUND 5 to 10 TIMES  
(according to diameter)

**'CARDINAL' TIPS ARE GRADE "B.S.N." (I.S.O.-K20)**

*Adjustment by coned screw*



**SHELL  
REAMERS**  
These Shell  
Reamers fit  
our standard  
range of  
arbors.

TAPER SHANK REAMERS

Carbide Tipped Shell Reamers are manufactured in a range of sizes from 1in. diameter upwards, and the Taper Shank type from  $\frac{1}{2}$ in. diameter upwards.

Our full range of standard H.S.S. Reamers is available EX STOCK from

**THE BROOKE TOOL MANUFACTURING CO. LTD.**

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## **“WRIGHT” TABLE SURFACE GRINDERS**

## **Wheel diameters from Eight to Twenty Inches**



**► SIMPLE TO OPERATE  
► EASILY ADJUSTED  
► PRECISION BUILT**

The illustration shows a "WRIGHT" Vertical Spindle Horizontal Table Surface Grinder Model 55/20, fitted with a working table extension. Affixed to this machine is the official emblem of the American Development Fund. Several of these machines have recently been supplied to Far Eastern Countries through the United States Financial Foreign Aid Programme.

Eight Model 55/20 machines are now in use in REPAIR and MAINTENANCE WORKSHOPS of the Union of South Africa Railways.

# **WRIGHT ELECTRIC MOTORS (HALIFAX) LTD.**

Manufacturing Electrical Mechanical Engineers

Phone : Halifax 60201/2  
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ESTABLISHED 1900

Grams : MOTOR Halifax

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November 1, 1961

MACHINERY

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## Super freecutting bright steel

**Produced specifically for CAPSTANS and AUTOS**

**BS 970 1955. EN.1A**

The engineering trade has long recognised the superior quality of this freecutting steel, which has acquired a wide reputation for ease of machining, high cutting speeds, long tool life and the ability to produce components of excellent finish and accuracy. Usaspead super freecutting bright steel is closely controlled for chemical composition and mechanical properties, and responds readily to normal case hardening treatment.

A complete range of EN specifications is available.



THE SECOND  
**Engineering  
Materials  
and Design**  
EXHIBITION and  
CONFERENCE  
EARLS COURT  
13th-18th  
NOVEMBER  
1961

**MACREADY'S**  
METAL COMPANY  
LIMITED

USASPEAD CORNER,  
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Telephone : TERminus 7060 and 7030 (30 lines)  
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MORE AND MORE LEADING MANUFACTURERS  
ARE INSTALLING



# Shadomaster

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## METHOD OF MEASUREMENT BY OPTICAL PROJECTION

So many of the best people in industry are now dispensing with old-fashioned mechanical gauging methods in favour of SHADOMASTER Optical Gauging Equipment. No more problems with checking radii, tapers, etc., and multiple dimensions inspected in a single operation.



We invite you to send for complete SHADOMASTER Catalogue . . . ask our SHADOMASTER specialist to call . . . or better still, ask that arrangements be made to demonstrate SHADOMASTERS to you.

## BUCK & HICKMAN LTD.

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Branches

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### THE NEW MODEL BC. 1512

This machine, the latest addition to the extensive SHADOMASTER range, is designed primarily for repetition gauging on mass produced component parts, but is also suitable for direct measurement.

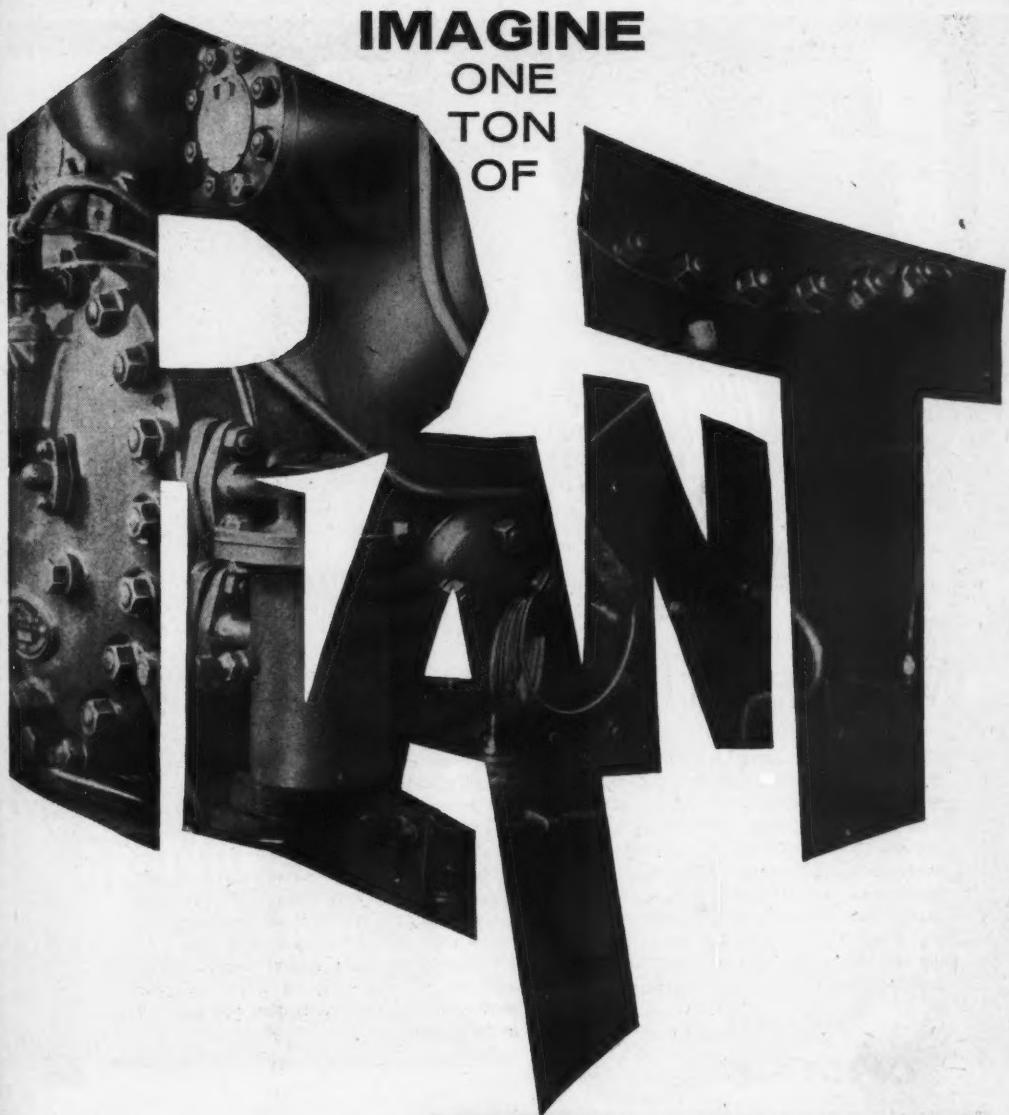
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**IMAGINE**

ONE  
TON  
OF



ON ONE  
SQUARE INCH  
OF CONCRETE  
**8 HOURS**  
AFTER PLACING

The compressive strength of 4:2:1 Fondu concrete reaches 1 ton per sq. in., only 8 hours after placing. At 12 hours old it rises to 2 tons per sq. in., and at 24 hours 3 tons per sq. in. Think what these phenomenal figures mean to you in saving time and labour. No other type of cement can provide such great strength at such high speed.



*The Cement for Industry*

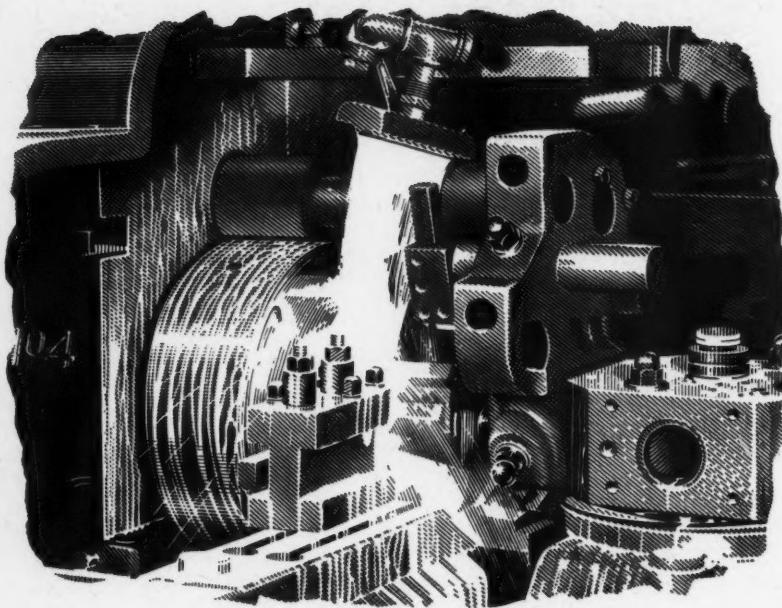
**ROCK-HARD CONCRETE IN HOURS — NOT DAYS**

LAFARGE ALUMINOUS CEMENT CO. LTD. 73 Brook Street, London, W.1 Telephone: MAYfair 8546

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## Who fixed the production target?

Not every machine operator has stars in his eyes! For the rest, a mundane sequence of speed changes, feeds and cuts produces a lot of little parts that other people want. And the easier the ways of doing this, the happier are both a bonus-seeking worker and a budget-minded management. In this idyllic atmosphere, it seems downright unsporting to drop a spanner in the works—and a whacking big one at that! Frankly, we don't always agree that the way things are done in metal cutting is necessarily right. Producing such good cutting

fluids—and so many of them—tends to bias our outlook of course but have you ever tried, at one and the same time, to pull the wool over the eyes of a metallurgist, a planning engineer, a graph-watching production assistant and—bless them—a cost-conscious purchasing officer? It is just impossible. The fact is Fletcher Miller cutting fluids are on good terms with all these gentlemen—and those worthy fellows at shop floor level who actually use them. Relieve yourself of one headache by consulting us about all your production oils. The cure is quite painless. Call in the experts.

*choose*

**FLETCHER MILLER**

*cutting fluids*

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# LUSCHER

*Made in the finest  
tradition of Swiss  
craftsmanship . . .*

## 4 wheel combination carbide tool grinding and lapping machine



### Specification

To take grinding & Lapping Wheels. 6in. dia.  
Power of main motor. 1 h.p.  
Size of inclinable table. 24in. by 9½in.

Attachments Available. for Chip Breaker  
groove grinding, Nose radius grinding, twist  
drill grinding. Also oversize Table, Grinding  
Wheels, Lapping Wheels, Lighting equipment.

**HERBERT WIDDOWSON  
& SONS LIMITED**

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**Sparking time:**

**$3\frac{1}{2}$  hours**

THIS PEDAL PAD FORGING DIE took  $3\frac{1}{2}$  hours to make on the new GKN Spark Machine, Model B1. How long would it have taken by other methods?

When you've worked it out, consider the GKN Spark Machine. *It is faster, more accurate, more versatile, more compact and better designed than any other machine of its kind, yet both installation and running costs are low.*

The GKN Spark Machine was designed by the GKN Group Research Laboratory. Not only is it backed by all the Laboratory's technical resources, but *every user of the GKN spark machine can count on regular visits from the makers' technical representative to ensure that he gets the most from his machine.*

Whether you are engaged in forging, wire-drawing or press-tool making, the GKN Spark Machine is something it will pay you to know about. Ask our sales agents for an illustrated brochure on the GKN Spark Machine (Models B1 & B2). Ask them now.

## The **GKN** Spark Machine

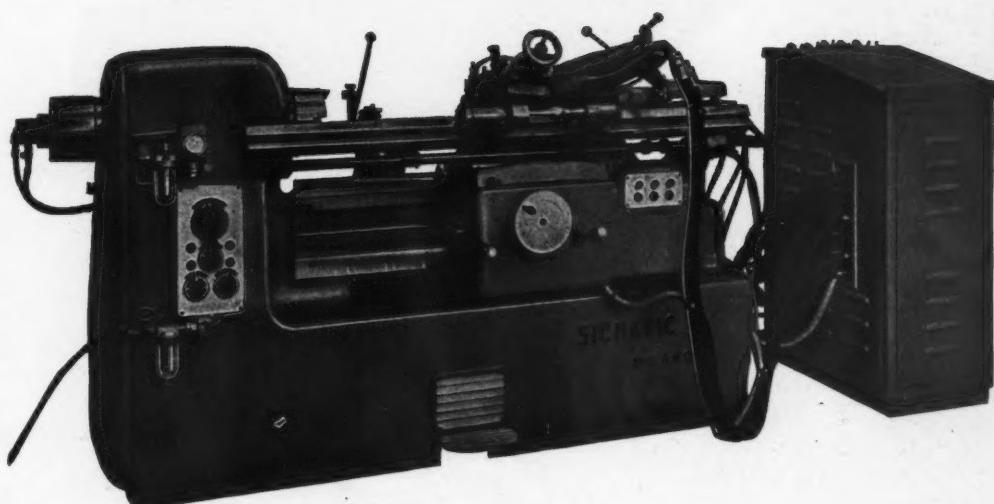
DESIGNED BY THE GKN GROUP RESEARCH LABORATORY

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The **NEW** **SICMATIC**



**Automatic  
and  
Semi-Automatic  
Hydraulic  
Profiling  
Lathes**

**Specification**

Bore of spindle	... 2½in.
Spindle nose	... 5in. A.S.A.
Max. swing over bed	... 15½in.
Max. swing over saddle	... 9½in.
Max. length turned	... 27½in.
Hydraulic traverse of copying slide	... 4in.
Hydraulic feed of tailstock spindle	... 4½in.
Number of feed rates to copying slide	... 48
Max. tool pressure	... 1,300 lbs.
Approx. net weight	... 5,000 lbs.

**7**

**POINT FEATURES INCLUDE**

- 1 Capacity.
- 2 Duplomatic Hydraulic Systems.
- 3 Hardened Bed Slideways.
- 4 Auto cycling up to six depths of cut.
- 5 Hydraulic tailstock for drilling and boring.
- 6 Uses template or existing component.
- 7 Eight models to choose from.

**Basic price under £2,500.**

**QUICK DELIVERY**

Daily demonstrations at our works



**HERBERT WIDDOWSON & SONS LTD**

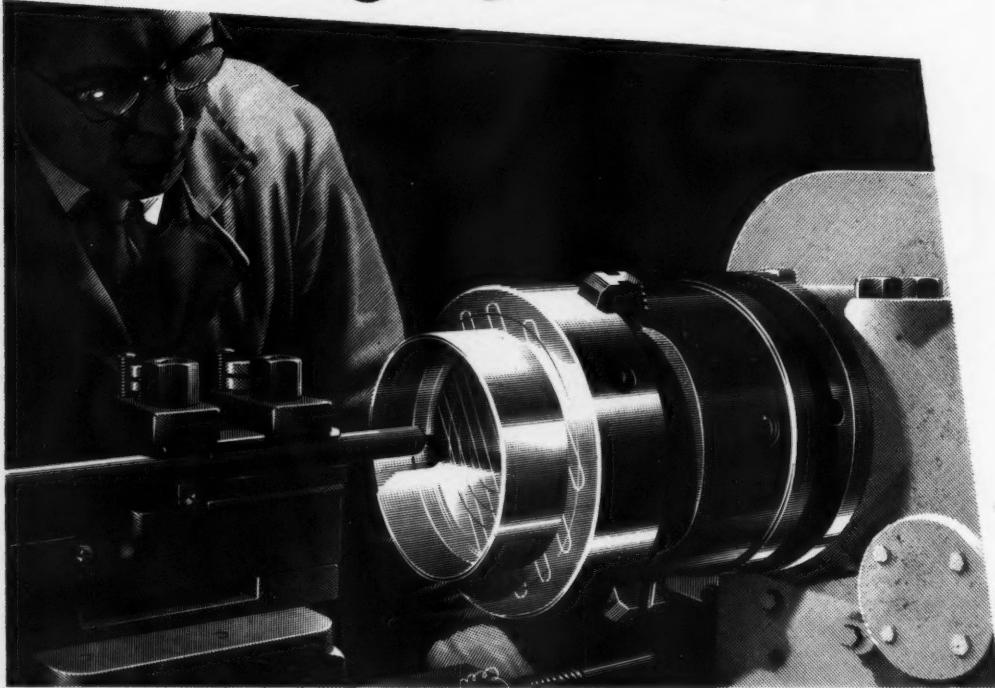
Canal Street Works, Nottingham

Telephone: 51891 (4 lines) Telegrams: TOOLS NOTTINGHAM

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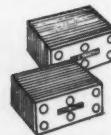
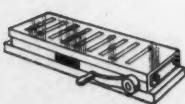
# NO DISTORTION

when holding fragile workpieces



the first name for magnetic tools

Don't waste time fixing a face plate—save time and fit an Eclipse Magnetic Lathe Chuck. If you want advice on magnetic workholding consult the "Eclipse" experts.



**users' handbook and technical specifications available on request**

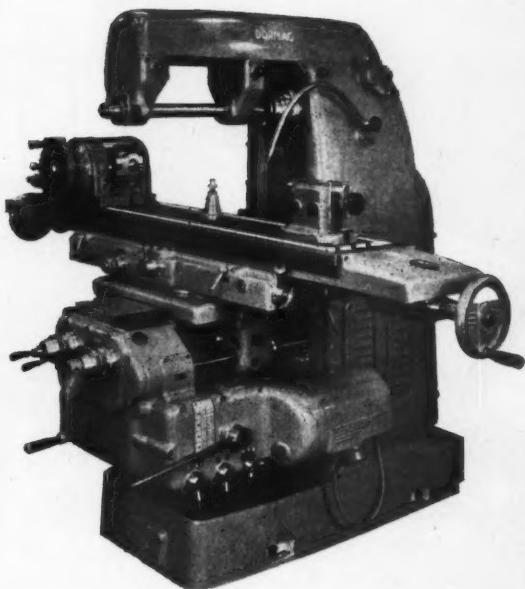
MADE BY JAMES NEILL & CO (SHEFFIELD) LIMITED—SUPPLIES THROUGH YOUR USUAL 'ECLIPSE' DEALER

# DORMAC

## UNIVERSAL MILLING MACHINES

*All models complete with  
standard equipment  
including :*

- POWER FEEDS AND QUICK POWER TRAVERSE IN ALL DIRECTIONS
- FULLY UNIVERSAL DIVIDING HEAD
- VERTICAL ATTACHMENT
- BACK-LASH ELIMINATOR
- ARBOR
- FRONT BRACES



*A Demonstration Model Always in Our Showroom*

No. 1.

TABLE 43" x 10½"  
LONG, TRAVERSE  
28", 12 SPEEDS TO  
1,600 R.P.M.  
No. 40 SPINDLE.

PRICE: £1,900

No. 2.

TABLE 51" x 11½"  
LONG, TRAVERSE  
33", 12 SPEEDS TO  
1,400 R.P.M.  
No. 40 SPINDLE.

PRICE: £2,325

No. 3.

TABLE 60" x 12"  
LONG, TRAVERSE  
41", 12 SPEEDS TO  
1,600 R.P.M.  
No. 50 SPINDLE.

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SPECIAL TERMS TO MEMBERS OF B.A.M.T.M.

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CANAL STREET WORKS NOTTINGHAM

TELEPHONE: 51891 (3 lines)

TELEGRAMS: TOOLS NOTTINGHAM

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# HANDS FOR INDUSTRY...

LET the various powered movements of the machine be represented by A, B, C, etc. Let the sequence of operations in the cycle be represented as A+B+A-C+A+B-D+C-A-D-E-... And let...and let..... and let's call in the Martonair Technical Service, which seems to make a habit of doing this sort of thing.



THAT'S MARTONAIR—The first name in applied pneumatics.

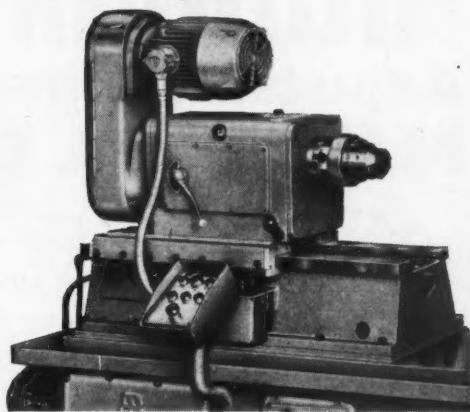
MARTONAIR LIMITED, Parkshot, Richmond, Surrey.  
Telephone: RICHMOND 2291. Telex 34350.  
Telegrams: Martonair-Richmond-Surrey-Telex.  
Cables: Martonair, London.

# BERARDI

*A name in Europe synonymous with*

# AUTOMATION

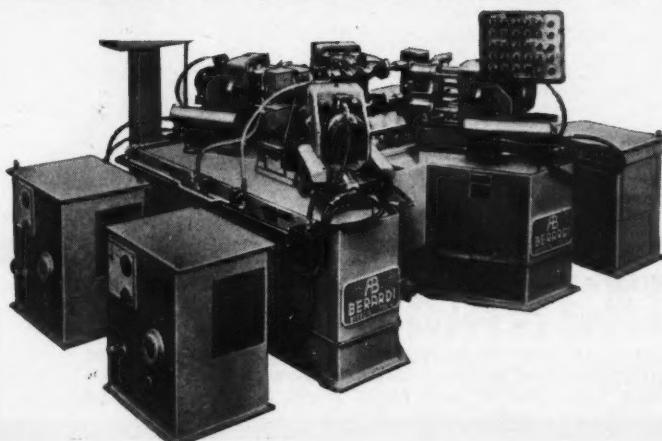
- Electro-Hydraulically Controlled
- Flexibility with standardisation of Units
- Handling reduced to minimum
- Consistent Production



Our Development Engineer always  
available for discussion

Tel: Nottingham 51891  
Cheswardine 277

## HERBERT WIDDOWSON & SONS LTD



CANAL ST.  
WORKS  
NOTTINGHAM

Tel: 51891  
(4 lines)

Grams: TOOLS  
NOTTINGHAM

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CUT your drilling costs



# CORONA

## Adjustable Spindle MULTIPLES

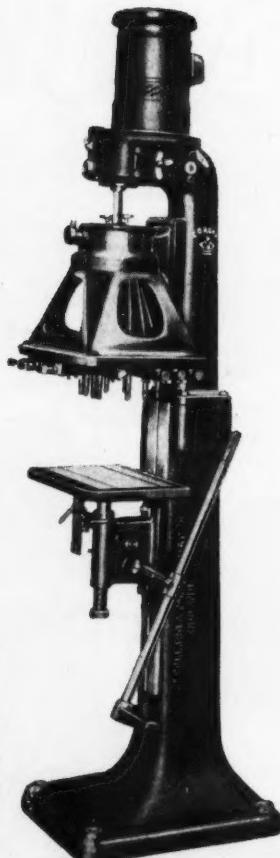


**TYPE 12 MX**  
UP TO 12 SPINDLES IN AN AREA  
OF 12in. — 8in.  
MAXIMUM DRILLING CAPACITY  
8in.

These machines keep costs low on multiple repetition drilling. Any number of spindles up to 12 can be employed and adjustment is rapid and simple. Feed is by lever and rack-operated table with a vertical adjustment of 20in. Available with electrical reverse.

**TYPE 6 MX**  
BENCH OR PEDESTAL  
UP TO 10 SPINDLES IN AN AREA  
OF 5in. DIA.  
MAXIMUM DRILLING CAPACITY  
0.196in.

Available with or without electrical reverse, these machines will drill and tap small components at very fast rates. Tee-slotted table has lever feed. Head has 6in. vertical adjustment. Two speed ranges through gear box. Maximum speed 3,000 r.p.m.



**FREDK POLLARD & CO LTD**

CORONA WORKS, LEICESTER, ENGLAND, • TEL: LEICESTER 67534 (5 lines)

London Office: COASTAL CHAMBERS, 15 ELIZABETH ST., BUCKINGHAM PALACE RD., S.W.1. TEL: SLOANE 8888

Scottish Representatives: WALTER S. LANG & CO., 48 OSWALD STREET, GLASGOW, C.I. TEL: CENTRAL 2339

North East: HODSON MACHINE TOOLS LTD., 150 NEW BRIDGE STREET, NEWCASTLE-UPON-TYNE

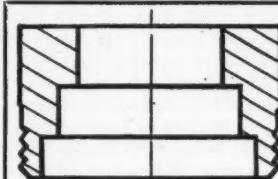
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# Yet another example of PRODUCTIVITY!

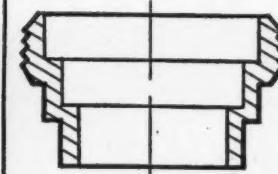
## KUMMER

There are many operations where the Kummer K20 can show handsome savings. This is one of many typical examples. Suitable for work on bar, castings, forgings and stampings.

**K20** Semi-Automatic Twin-Head PRECISION LATHE ...



**SCALE FULL SIZE**



**Operation 1**  
Loading 6 secs  
Machining 28 secs  
Material—BRASS  
(Billet)

**Operation 2**  
Loading 6 secs  
Machining 43 secs  
Material—BRASS  
pre-machined blank  
from Op. 1.

- Work head spindle can automatically operate at high or low speeds according to preselected cutting speeds.
- Camshaft driven from main spindle.
- Cam accelerator reduces machining cycle time.
- Air-operated chucking.
- Spindle positioning device for irregular shaped components.
- Easy loading of components into chucks.
- Write for full data.

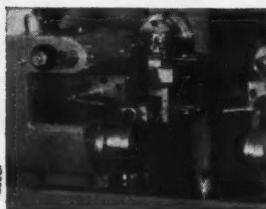


Illustration shows tailstock which is one of the many optional features available.

## GASTON E. MARBAIX LTD.

Devonshire House, Vicarage Crescent, Battersea, S.W.11.

Phone : Battersea 8888 (8 lines)

NRP 3424

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# Post Office STAMPS on waste

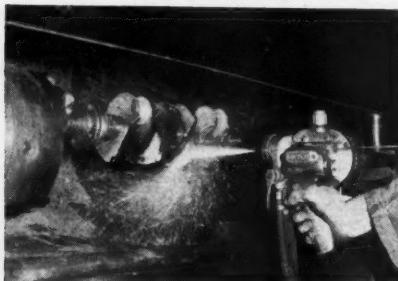
## METCO SAVES G.P.O. THOUSANDS

The G.P.O. repair depot at Yeading, Middlesex has a big job to do. It is responsible for keeping in good repair all the G.P.O. vehicles in the London and Home Counties area. Throughput of vehicle rebuilds is over 1,500 a year and over 2,250 engines a year arrive at Yeading for reconditioning.

By installing METCO flame spray equipment they estimate that thousands of pounds have already been saved by salvaging worn parts which were previously scrapped.

Why not let Flame-spraying help increase your profits? It can in many ways—salvaging worn parts, hard facing original equipment for increased life, or zinc or aluminium spraying for corrosion protection.

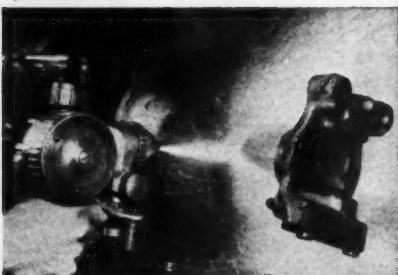
A booklet giving Engineering Data on Flame-Sprayed coatings is available from METCO. Please complete or pin the coupon below to your letterheading and send it for your copy.



*After two or three regrinds, these crankshafts would previously be scrapped. Now the journals and pins are rebuilt to "as new" diameters at a fraction of their replacement cost.*



*Here, the metallized crankshaft is ground to standard size. In service it will give longer life than original.*



*The metallizing department at the G.P.O. repair depot handles a wide variety of undersize components. Typical, is the stub-axle which is being rebuilt on the bearing-fit diameters.*



REGISTERED USER

**METCO LTD**

FORMERLY: METALLIZING EQUIPMENT CO. LTD.

CHOBHAM • WOKING • ENGLAND • Telephone: Chobham (Woking) 590

**METCO LTD**

Chobham Woking England  
Please send information  
on Flame-Spraying.

NAME \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

E17

Registered user of  
Trademark 'METCO'.

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**SMALL METAL PARTS**

*efficiently and rapidly*

# Washed Rinsed and Dried

by

*Sturtevant*  
**MACHINES**



*Revolving drum-type dryer for small metal parts.*

Sturtevant will investigate new production problems and design special machines to meet individual requirements.

Our publication MY4709 describing these machines will be supplied on request.

These machines provide rapid batch or continuous in-line treatment and are available as complete units or in three stages—washing, rinsing, drying.

SPECIALISTS IN  
ALL TYPES OF FANS  
HEATING AND VENTILATION  
AIR CONDITIONING  
AIR FILTRATION  
FUME REMOVAL  
DRYING  
DUST COLLECTORS  
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PNEUMATIC CONVEYING  
INDUSTRIAL VACUUM CLEANING  
CRUSHING, GRINDING, SCREENING  
AND SEPARATING  
CATHODIC PROTECTION



**STURTEVANT ENGINEERING CO. LTD., SOUTHERN HOUSE, CANNON STREET, LONDON, E.C.4**

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**DRIVE FOR SMOOTH PRECISION  
WITH INDUSTRIAL DIAMONDS**

The finest pistons are turned with diamond tools and, for matching precision, their connecting rods are honed with diamonds. Industrial diamond tools cut, grind, and polish with unsurpassed speed and accuracy and so make a vital contribution to increased efficiency and production in thousands of engineering processes.

To find out if diamond abrasives, diamond tools or diamond impregnated wheels can help you in *your* problem, please get in touch with the Industrial Diamond Information Bureau. This Bureau is backed by the world's largest laboratory devoted to diamond technology - The Diamond Research Laboratory in Johannesburg. For information and advice, without obligation, please write to the address below.

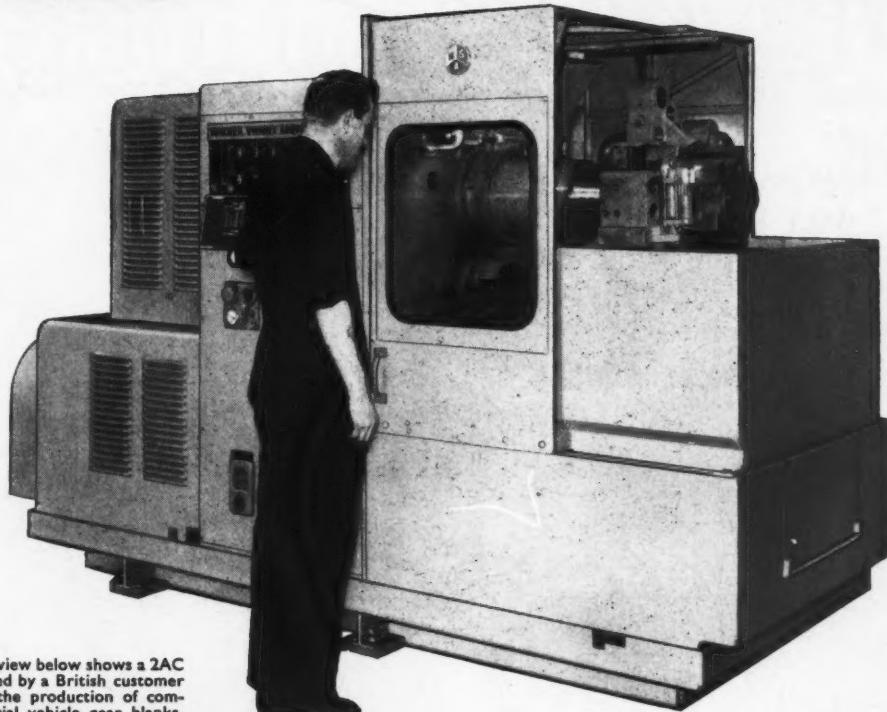


**The Industrial Diamond Information Bureau**

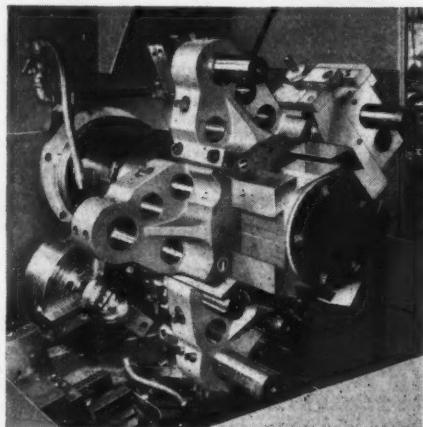
2 CHARTERHOUSE STREET (DEPT. 2), LONDON, E.C.1.  
Telephone: Fleet Street 7157

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# 2AC Automatic for Versatile Production



The view below shows a 2AC tooled by a British customer for the production of commercial vehicle gear blanks.



You complete more jobs on the 2AC Single Spindle Chucking Automatic, fewer second operations are needed and standard tool and machine functions will handle most work. Built-in rigidity and accuracy are features that ensure the holding of close tolerances and speeds and horsepower permit effective use of today's most advanced cutting tools. Because of their fast set-up features, batchwork can be produced more profitably on an automatic basis. A 12" air-operated chuck is fitted.

## *British Built*

WARNER SWASEY ASQUITH LTD.  
HALIFAX • ENGLAND



Sales and Service for the British Isles

**DRUMMOND-ASQUITH LIMITED**

Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE, NEW ST., BIRMINGHAM Phone Midland 3431 Also at LONDON Phone Trafalgar 7224 & GLASGOW Phone Central 0922

WSA 498

# YOU WILL GET—

**SEVERAL TIMES MORE BLANKS PER RE-GRIND!**

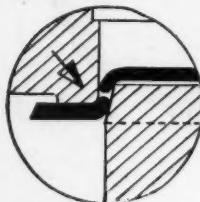
*Plus—*

**ONLY HALF GRIND-OFF  
ALLOWANCE FROM DIE  
SURFACE**

*equals—*

**MANY TIMES LONGER  
TOOL LIFE**

*The above claim has been confirmed by a large number of tests and by experience of our customers.*

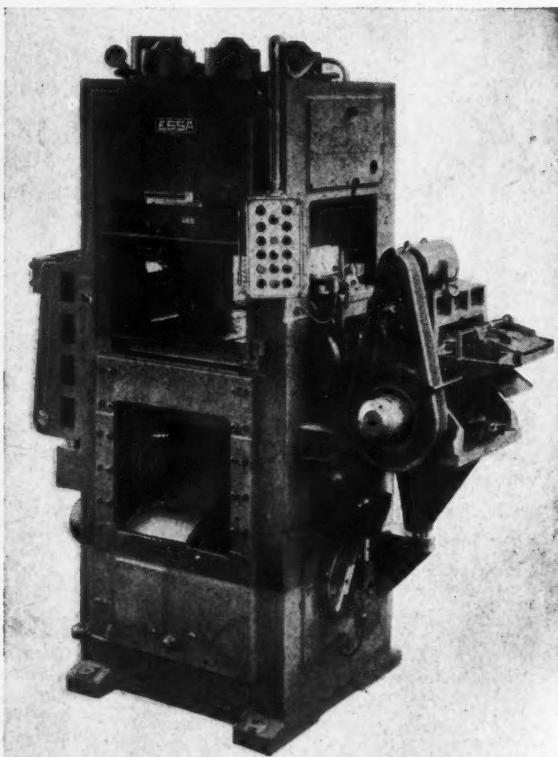


**FORMERLY:** Ordinary Press  
—tool breakage.



**NEW: B.H.A. PRESS**  
No penetration.

The upwards movement of the ram automatically eliminates vertical backlash: the cause of punch into die penetration. This feature is especially important when tungsten carbide tools are used.



# ESSA

**AUTOMATIC PRESSES**  
**MODELS BHA 30, 60, 120, 180t.**

MEANWHILE FULL DETAILS GLADLY SENT ON REQUEST  
OR A DEMONSTRATION READILY ARRANGED.

**VAUGHAN**  
ASSOCIATES LIMITED

VAUGHAN HOUSE, 4 QUEEN ST., CURZON ST., LONDON, W.I  
Telephone: GROSVENOR 8362-5

Midland Office: WILFORD CRESCENT, NOTTINGHAM Tel. 88008

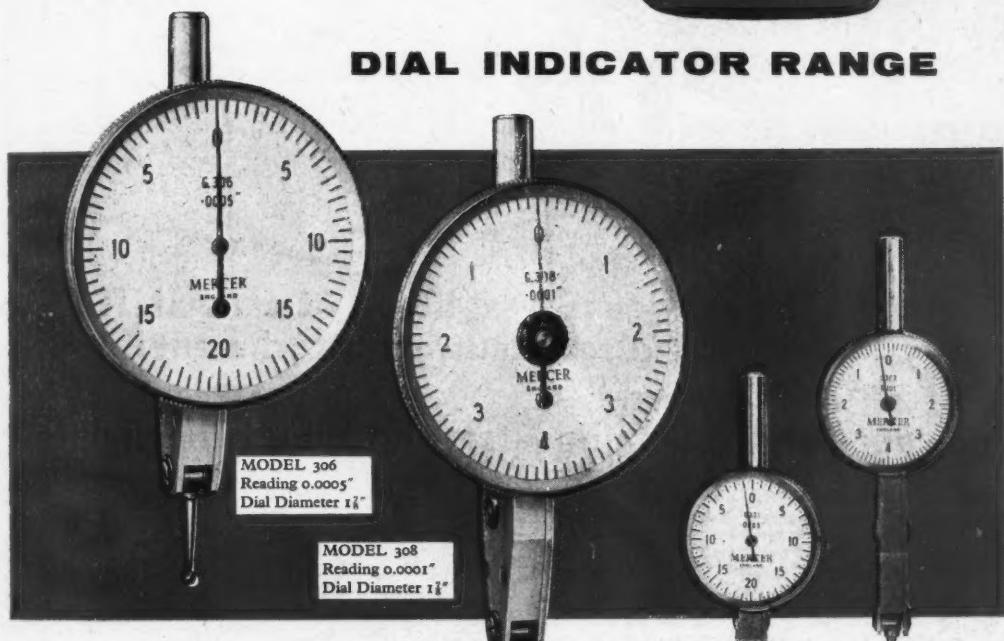
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additions to the



### DIAL INDICATOR RANGE



*All models have these features*

- "Two way" stylus action with no reversing lever
- Readings in a clockwise direction whichever way stylus is moved
- All geared mechanism for accuracy and sensitivity
- Measuring pressure under 1oz.
- Standard stylus  $\frac{1}{8}$ " long
- Supplied in case with height gauge adaptor

**ONE HUNDRED YEARS OF FINE MEASUREMENT**

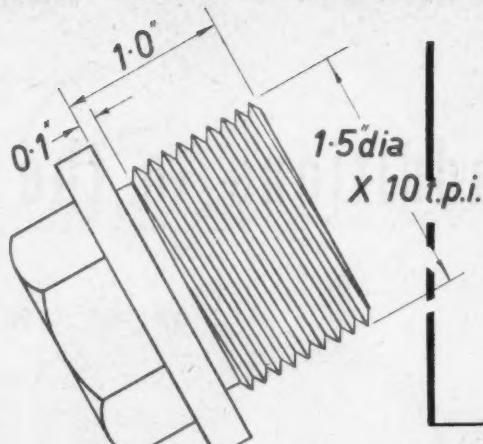
**THOMAS MERCER LIMITED**

of St. Albans, Hertfordshire. TELEPHONE ST. ALBANS 55313

Scottish Office : J. F. Tennent Ltd. 52, St. Enoch Square, Glasgow, C.I.



Could you screwcut  
this 'Nimonic 80'  
component in 25 secs.  
on a centre lathe?

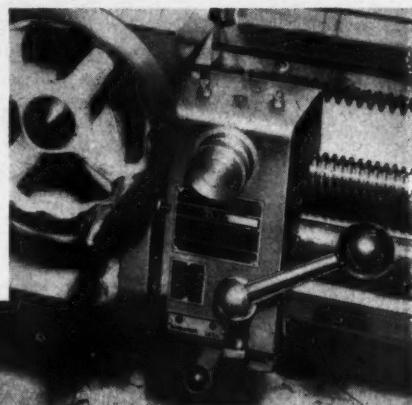


The answer is 'yes' if you fit an 'AINJEST'  
high speed screwcutting attachment!

## For I off and upwards Toolroom or Production — setting time is negligible.

In the same way that the chasing dial has superseded the old method of marking chuck, headstock, leadscrew collar and bracket; the AINJEST HIGH SPEED SCREWCUTTING ATTACHMENT has established a further major advance in screwcutting techniques. Its use on standard centre lathes allows the automatic engagement and disengagement of the leadscrew at the highest spindle speeds of which the machine is capable.

- ★ The cut cannot be started at the wrong point.
- ★ The cut is stopped accurately so that the external or internal threads can be cut tight to a shoulder at high speeds.
- ★ Tungsten carbide tools can be used with great advantage.
- ★ Chasing dial is eliminated.
- ★ The attachment remains in position, ready for use without restricting the versatility of the lathe.



**High speed SCREWCUTTING ATTACHMENT**

● stockists of "KENNET" carbide threading and turning tools

Write for details and prices to Dept. A.S.C.  
**SAUNDERSON & COSTIN LTD. • HIGHCLERE • NEWBURY • BERKS • ENGLAND • Tel: HIGHCLERE 448**

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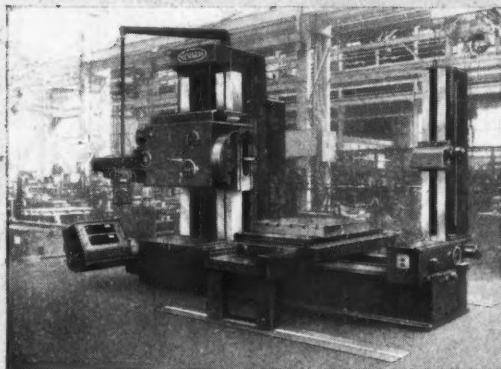
**THE BADGER (MELES MELES)**, more commonly known as "Brock", lives in a "Set", an underground hollow bored ten or more feet below the surface. This may have several passages and upper galleries with probably a back door some distance from the main entrance. It is no unusual thing for the upper passages communicating with the entrance to be tenanted by foxes—or even rabbits!

*The  
Meles Meles Meles  
is  
Efficient  
But hardly a*

Illustrated right is the Richards Electrabore Table Type Horizontal Boring, Facing, Milling and Tapping machine with outrigger supports to table unit, fitted with co-ordinate positioning equipment, with traversing spindle diameters 2½in. to 6in.



HORIZONTAL and VERTICAL BORERS produced by GEORGE RICHARDS & CO. LTD., however are unsurpassed for precision, speed and adaptability. Continuous research and development keeps RICHARDS borers way ahead of all others.



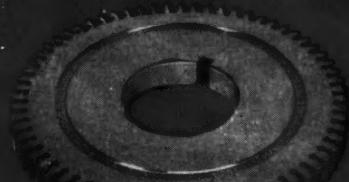
**RICHARDS**

**GEORGE RICHARDS & CO. LTD.**  
**BROADHEATH-ALTRINCHAM-CHESHIRE**  
Sole Agents: ALFRED HERBERT LTD., FACTORED DIVISION, COVENTRY.

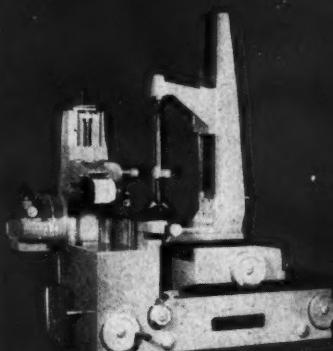
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***David Brown MACHINES***

... with  
***David Brown CUTTERS***



... with ***David Brown***  
***MEASURING EQUIPMENT***



... for best results!

**Co-ordinated equipment  
for maximum  
efficiency  
on gear shaving**

All your gear shaving and testing equipment from one organisation. The perfect relationship in design and performance, giving peak efficiency at every stage. That's the ideal for best results. And that's what you get when you buy David Brown gear shaving and measuring equipment. David Brown are ready to prove it!

**DAVID BROWN**



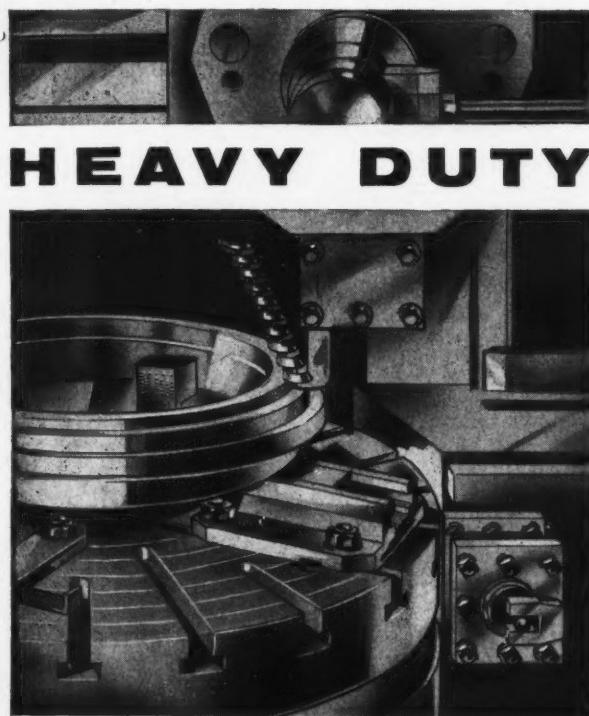
THE DAVID BROWN CORPORATION (SALES) LTD.

MACHINE TOOL DIVISION, ASHBURTON ROAD,  
TRAFFORD PARK, MANCHESTER 27.  
Telephone: TRAFFORD PARK 4741.

TOOL DIVISION, PARK WORKS,  
HUDDERSFIELD.  
Telephone: HUDDERSFIELD 3500.

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**O.DÖRRIES AG**

**vertical  
boring  
and  
turning**

**DÜREN**

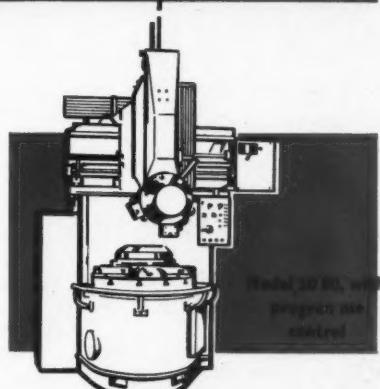
BUILDERS OF FINE MACHINE TOOLS SINCE 1877

Dörries Boring Mills offer you high rate production times plus simplicity of operation and high accuracy.

Idle time is kept to an absolute minimum. Available as single and double column machines, with auto cycle, auto-tripping and automatic cutting speed control.

*Learn about the Dörries range now!  
Range of eight sizes.*

Exclusive distributors in the United Kingdom.

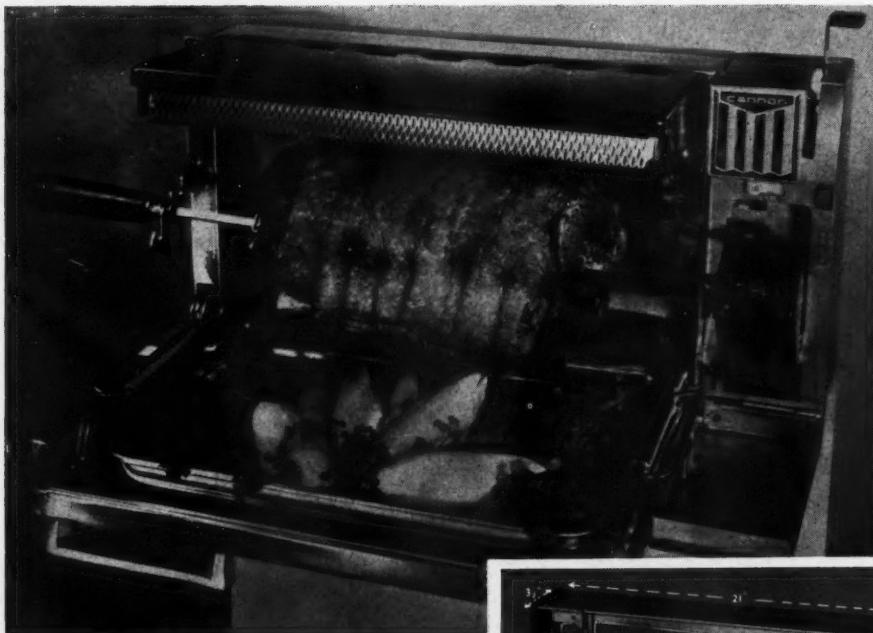


**ELGAR**

**MACHINE TOOL COMPANY LIMITED**

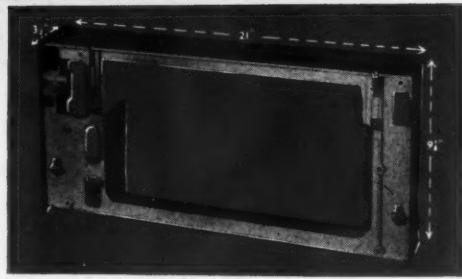
172-178, VICTORIA ROAD · ACTON · LONDON W3 · Telephone: ACORN 5555  
MIDLANDS SHOWROOM: 1075 KINGSBURY ROAD, ERDINGTON, BIRMINGHAM 24 · Tel.: Castle Bromwich 3781/2  
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# FOOD FOR THOUGHT

*Main Grill Frame for  
Cannon "SuperChef"  
Rotisserie-Grill, Cast  
by Birmingham  
Aluminium Casting  
(1903) Co. Ltd., using  
KE A145 steel dies.  
Photograph by courtesy  
of Cannon Industries  
Limited.*



*if you're Die Casting*

- \* KE Steels are electrically melted to close limits of analysis and regularity of properties.
- \* Die Blocks are ultrasonically tested.
- \* Die steels are ready for quick delivery from large stocks.
- \* Heat treatment service is available for all dies made from KE Steels.

**KE A145 5½% CHROME VANADIUM MOLYBDENUM DIE STEEL**  
**KE 896 MEDIUM CARBON CHROME VANADIUM DIE STEEL**

*Our local Technical Representative would be pleased to call on you to discuss your die casting problems at any time. Just 'phone Head Office, Sheffield 22124; London, Bayswater 9131/2; Birmingham, Coleshill 2041/2.*

**KAYSER ELLISON & CO. LTD.**

CARLISLE STEELWORKS, SHEFFIELD 4

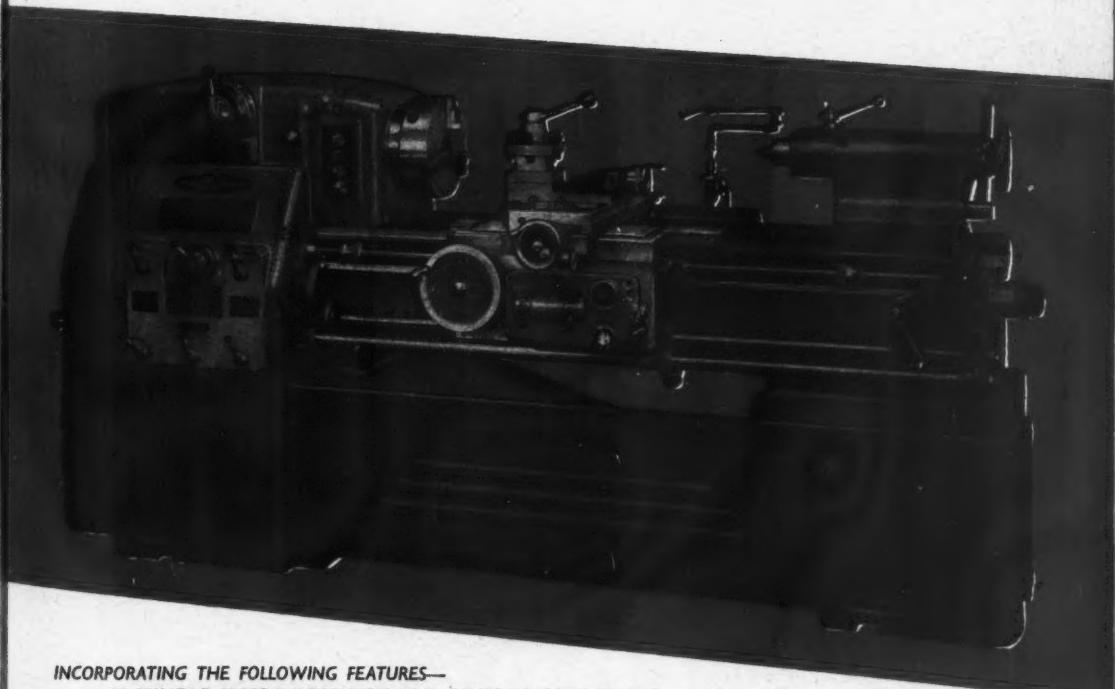
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*This booklet gives full details and is available free on request.*



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# *Introducing the NEW MODEL 'H' No. 17 PRECISION LATHE*



#### INCORPORATING THE FOLLOWING FEATURES—

16 SPINDLE SPEEDS (FORWARD AND REVERSE) WITH SINGLE LEVER CONTROL.

CAM-LOCK SPINDLE NOSE, 2½" DIA. HOLE  
SINGLE HELICAL GROUND GEAR, FINAL DRIVE.  
TOTALLY ENCLOSED GEARBOX AND APRON.  
60 DIRECT CHANGES OF THREADS AND FEEDS.

PRECISION LEADScrew AND COMPENSATED THRUST.

#### ALSO AVAILABLE—

ALTERNATIVE SPEED RANGE, BED LENGTH, RAPID POWER TRAVERSE, TWO-SPEED TAILSTOCK.

STANDARD MODEL  
20" SWING OVER BED  
42" BETWEEN CENTRES  
SPINDLE SPEEDS 15-1000 R.P.M.

HYDRAULIC PROFILING EQUIPMENT  
TAPERING EQUIPMENT ETC.

**HOLBROOK**  
**MACHINE TOOL CO. LTD.**  
CAMBRIDGE ROAD, HARLOW, ESSEX

Telephone :

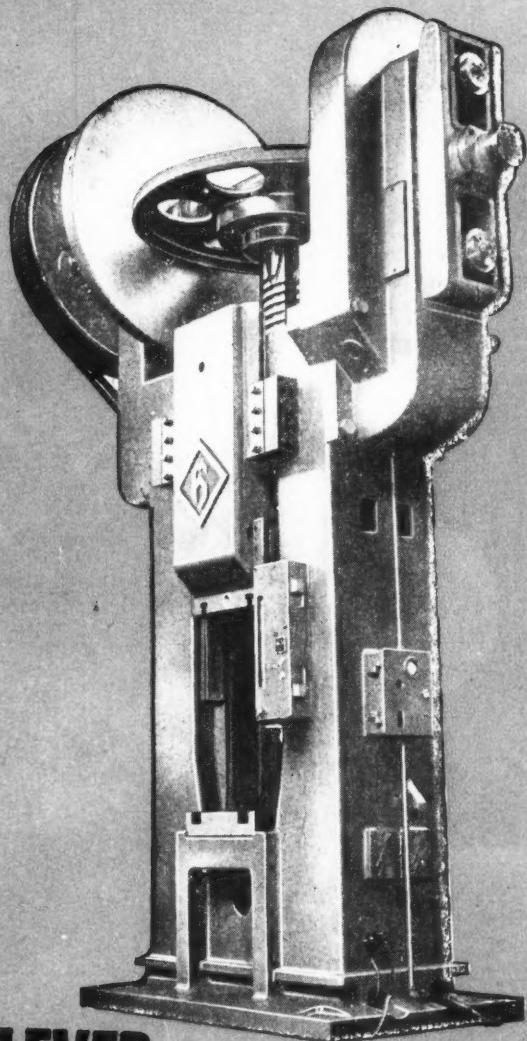
HARLOW 2351

**REMEMBER!**

**IT'S PAUL GRANBY**

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**FOR—**



# HASENCLEVER Friction Screw Presses

*with electronic variable blow selector*



**PAUL GRANBY & CO. LTD.**

39 VICTORIA STREET • WESTMINSTER • LONDON • S.W.1

Telephone: ABBEY 5338 Telegrams: POWAFORGE, SOWEST, LONDON. Cable: POWAFORGE, LONDON



*In all diameters and all strokes*

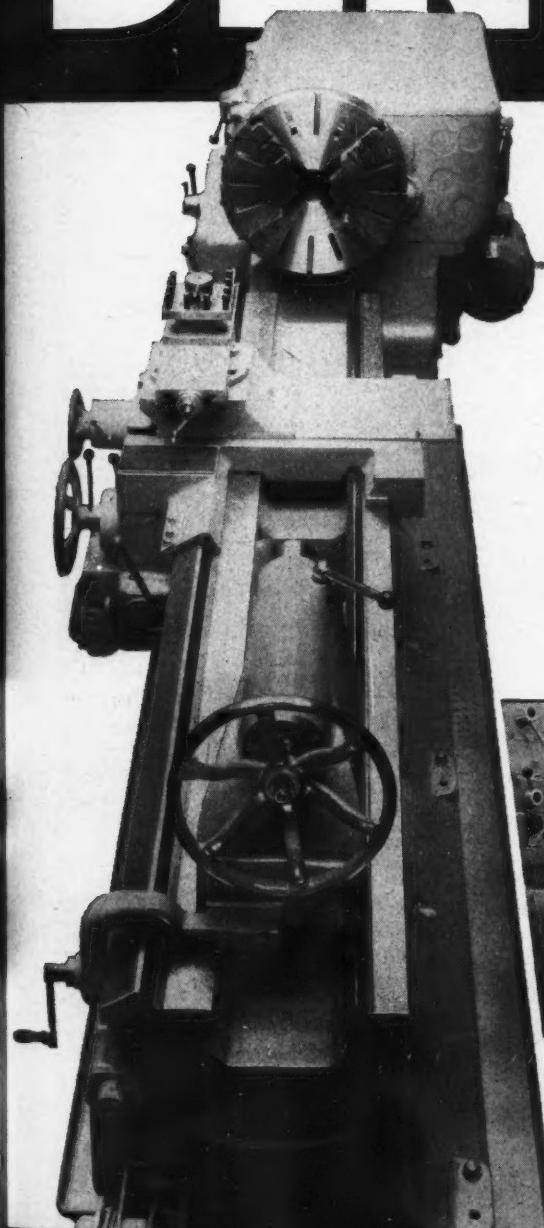
Hydraulic Cylinders of all sizes supplied to leading Manufacturers in a wide range of industries. We offer either our standard "Machine Tool" or "General Purpose" types or, alternatively, Cylinders specially designed to your individual requirements.

## CATTERMOLE HYDRAULIC CYLINDERS

H. S. CATTERMOLE & CO. (HYDRAULICS) LTD.  
ASTWOOD BANK, NEAR REDDITCH, WORCS.  
Telephone: ASTWOOD BANK 142/3

# DENHAM

## CENTRE LATHES



### MODELS

**BV. 28 — 29 in**

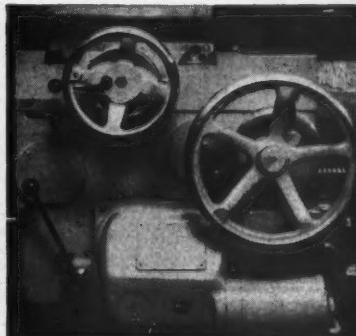
**BV. 32 — 32 in** *Swing over bed*

**BV. 36 — 37 in**

- 24 speed headstock
- 4.9-400 or 7.5-600 r.p.m.
- Helical final drive to spindle
- 48 change feed screwcutting gearbox

*Optional extras include :*

- 12 belt spindle speeds of 100-800 r.p.m.
- Power feed to 360 deg. swivelling tool-slide
- Quick power traverse of carriage and cross-slide



*Manufacturers of :*

Centre Lathes from 17" (430 mm) to 42" (1065 mm) Swing  
Surfacing and Boring Lathes of 17" (430 mm)  
and 25" (635 mm) Swing

TAS/CC.92

**DENHAM'S ENGINEERING CO. LTD., HALIFAX, ENG.**

*Member of the Charles Churchill Group of Companies*



# POLLARD BEARINGS



**POLLARD BALL & ROLLER BEARING CO. LTD**  
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*distribution throughout the world*

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THE

BIG

PEOPLE

for

MACHINE TOOL  
REBUILDING

are...

*Newman*

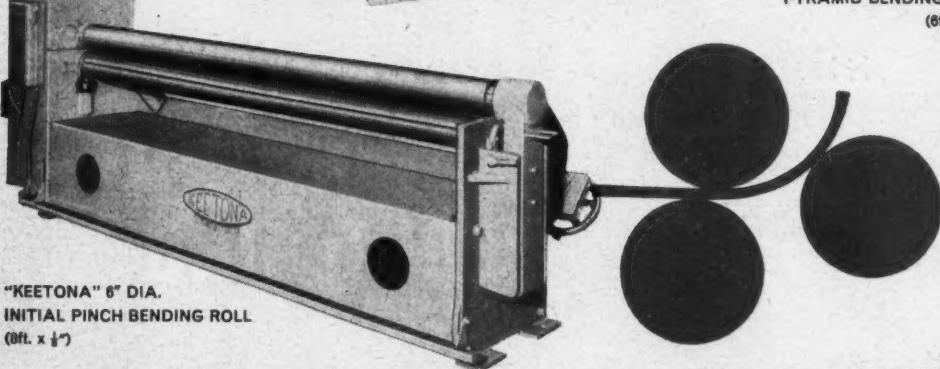
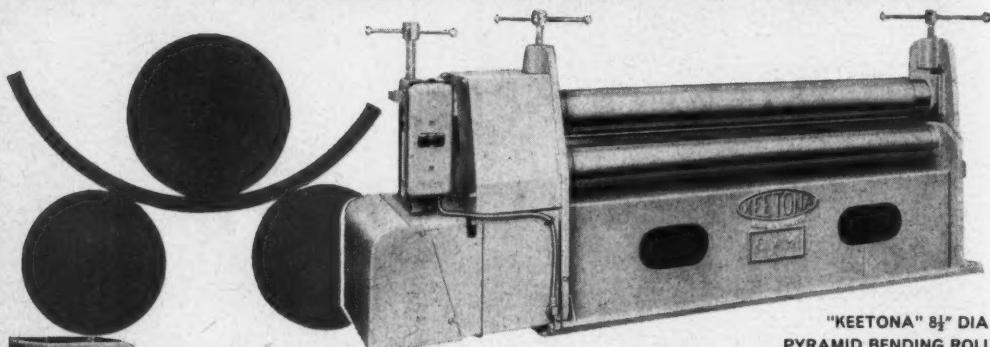
OVER A  
QUARTER OF  
A CENTURY'S  
EXPERIENCE

NEWMAN INDUSTRIES LIMITED

YATE • BRISTOL • ENGLAND

Telephone: Chipping Sodbury 3311

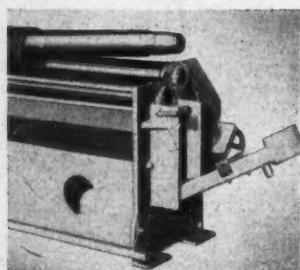
# THESE NEW "KEETONA" BENDING ROLLS CUT CYLINDER FORMING COSTS



This range of all steel Bending Rolls is designed for quick and easy forming of true cylinders. Adjustments for thickness and curvature are made easily and formed cylinders can be quickly removed, giving increased productivity. As with all new "Keetona" machine tools, these Bending Rolls are of fabricated steel construction for strength and rigidity. Other outstanding features include

- \* Full length safety bar—to prevent accidents
- \* Fully balanced drop end—to cut operator's fatigue
- \* Precision gearing—to ensure long service
- \* Grouped lubrication points for ease of maintenance

The range includes Bending Rolls of Initial Pinch and Pyramid types with rolls from 3" dia. to 8½" dia., in capacities from 16 g. sheet to ½" plate.



Counterbalanced drop end bearing in lowered position on 6" dia. Initial Pinch Roll.



## BENDING ROLLS

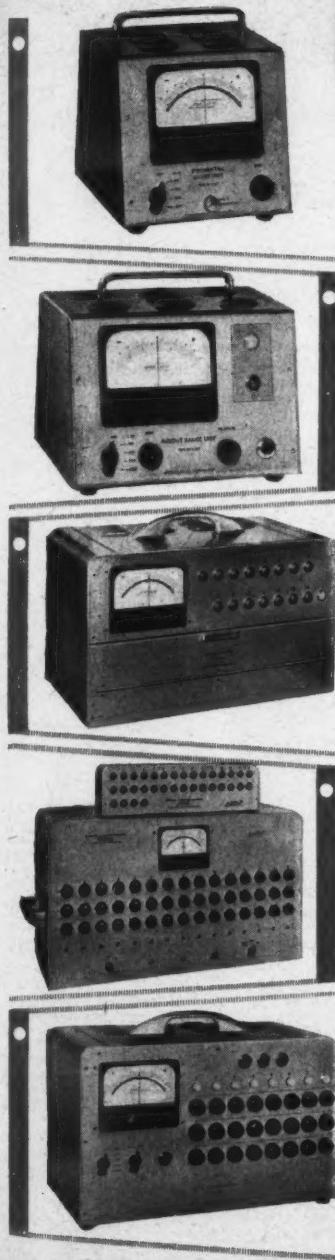
*For full details write to your nearest Stockist or direct to—*

KEETON SONS & CO. LIMITED · KEETONA WORKS · GREENLAND ROAD · SHEFFIELD 9

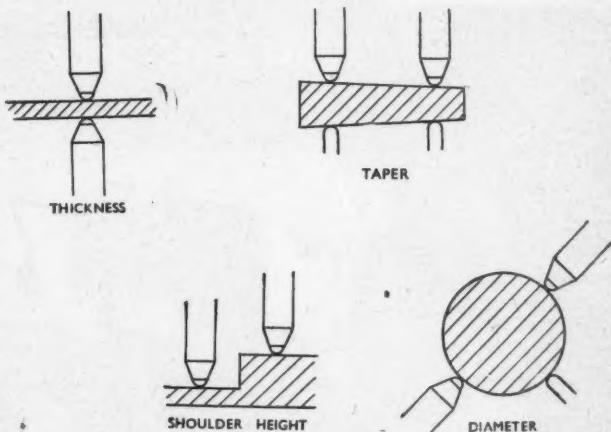
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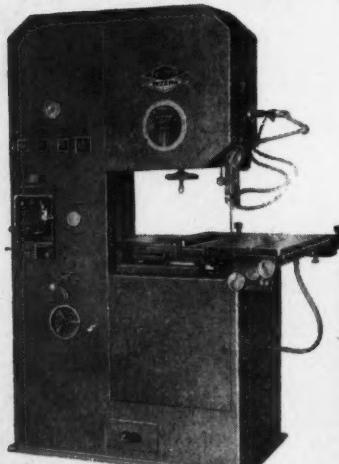
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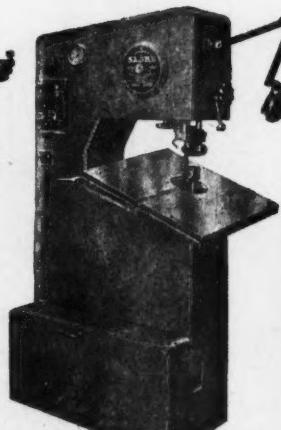
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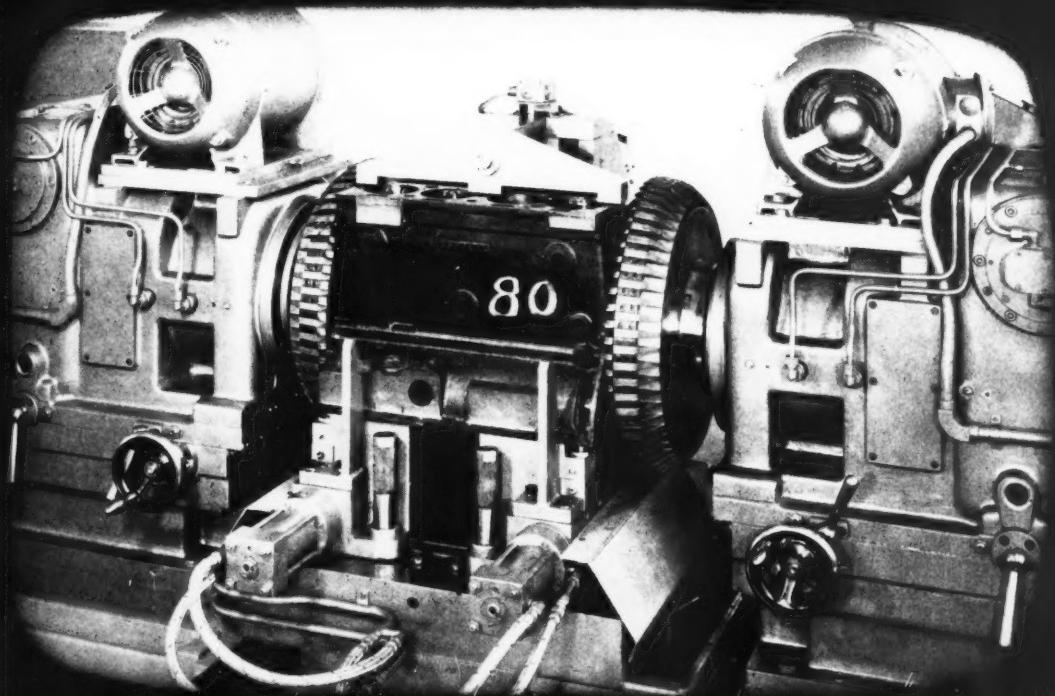
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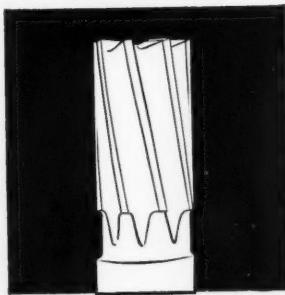
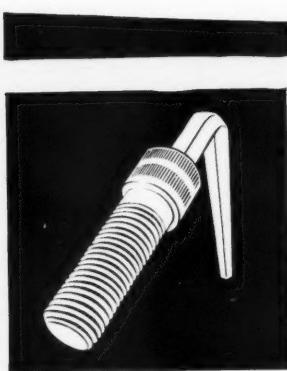
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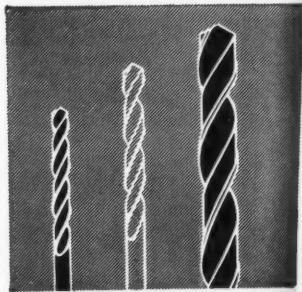
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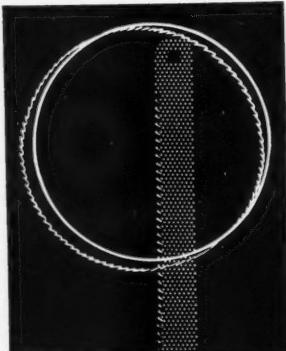
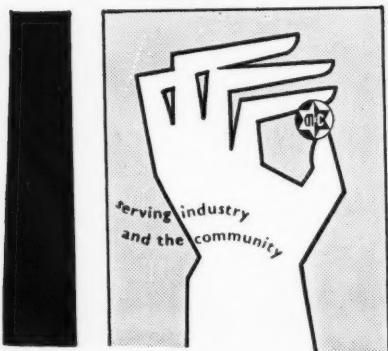
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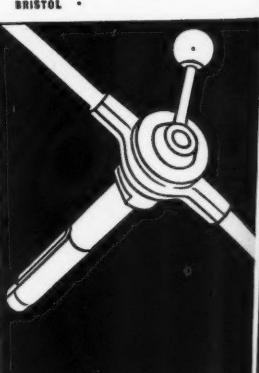
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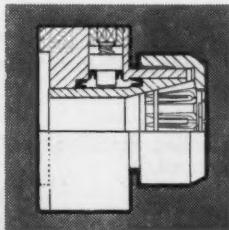


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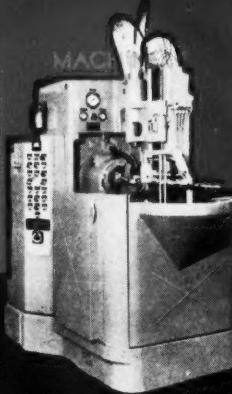
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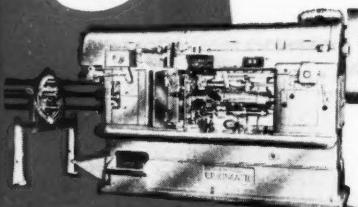
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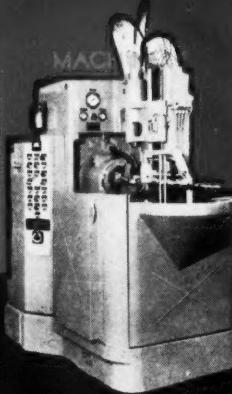
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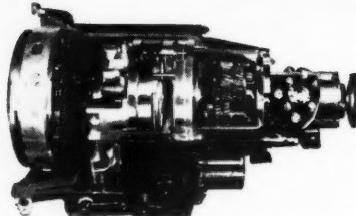
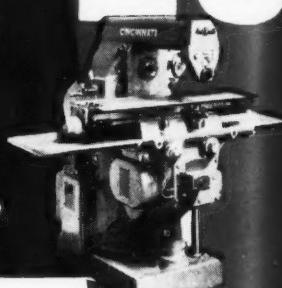
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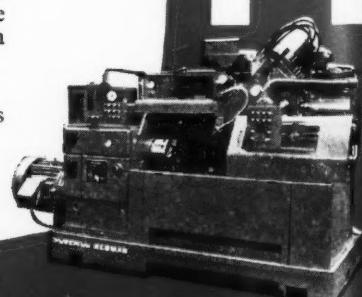
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## Abstracts of Principal Articles

### Producing Components for Box-making and Hardness Testing Machines . . P. 1004

Components for the box-making and hardness testing machines built at the Crayford works of Vickers-Armstrongs (Engineers), Ltd., require a large number of milling operations, and the company has installed a battery of Fritz Werner machines. There will eventually be 20 of these machines, of two types, on both of which automatically controlled milling cycles can be obtained. Extensive use is made of pendulum milling, with either conventional or climb cutting, and this method is employed in the production of clincher rams, different operations being performed at either end of the table traverse, and a third at a subsequent single-end milling set-up. A similar procedure is followed for knife blocks, which are machined four at a time. Former blanks for box-making machines are mounted in cradles, each of which holds 10 components, and the cradles are loaded in to fixtures at either end of a machine arranged for pendulum milling. Axis pins for hardness testing machines require a series of six operations to produce the two knife edges at each end, and blanks are mounted in collet-type holders, which are transferred from fixture to fixture during the machining sequence. (MACHINERY, 99—1/11/61.)

### Wadkin Type TCD.2 Tape-controlled Co-ordinate Drilling Machine . . . P. 1015

Built by Wadkin, Ltd., Green Lane Works, Leicester the type TCD.2 tape-controlled co-ordinate drilling machine installed at the works of Richardson Westgarth (Hartlepool), Ltd., is employed for drilling, tapping and counterboring numerous holes in large condenser plates for nuclear power station plant. It will accept plates up to 20 ft. by 14 ft., and is of the travelling bridge type, the work-table being stationary. Interchangeable 4-spindle attachments can be fitted to the drilling head, or a single-spindle unit can be employed for milling operations. (MACHINERY, 99—1/11/61.)

### Vibratory Finishing . . . . P. 1019

The vibratory finishing process provides basically for embedding workpieces in a mixture of medium, compound and water, and subjecting them to a controlled gyratory vibration by means of special equipment. Heavy scale, burrs and flash can be removed;

radii can be formed accurately; and surface finish can be greatly improved. Parts can also be cleaned, coloured, or burnished. In this article a number of typical examples of vibratory-finished workpieces are considered, and details are given of average processing times. (MACHINERY, 99—1/11/61.)

### Producing Gas Turbine Components

P. 1027

In this second article devoted to the practice of Rolls-Royce, Ltd., Derby, reference is first made to the milling of internal bearing pads in the outlet duct of the thrust reverser fitted to the Avon engine. An adjustable milling head, built by the company, is fitted to a Cincinnati No. 4 horizontal machine, and the work is supported in a fixture which incorporates multiple clamping and supporting members. For grinding a sealing face in the oil tank for the Tyne gas turbine, a Wadkin articulated arm router is employed. An extension arbor on the spindle of the routing head carries a taper cup wheel, which is run at 6,000 r.p.m., and the movement of the head is controlled by a masking plate. To provide for numerous index drilling operations, the company has built standardized indexing and tilting bases, whereon relatively simple jigs can be mounted. Provision is made for setting the work at any position from the horizontal to the vertical, also rotating it through 360 deg., and bushes in the associated jigs, or interchangeable quadrant plates, provide for accurate location. (MACHINERY, 99—1/11/61.)

### Profile Milling with Numerical Control on a 5-axis Machine . . . . P. 1032

A Giddings & Lewis Variax 5-axis profile milling machine, arranged for numerical control, is installed at the works of Douglas Aircraft Co., Long Beach, Calif., U.S.A., and important savings have been obtained in connection with machining complex structural parts for aircraft. Various examples of workpieces are described, and the production times for numerical control as compared with milling by conventionally-controlled machines are quoted. (MACHINERY, 99—1/11/61.)

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**EDITORIAL**

## Equating Incentive with Good Industrial Relations

After a setback in 1958 and 1959 there has been a welcome recovery in the rate of installation of new and more efficient machine tools and other manufacturing equipment which should have a considerable effect both on total industrial output and the productivity of the average worker. It is evident, however, that full advantage cannot be gained from the potentialities of the plant available—whether old or new—unless there is an enthusiasm for production at all levels. Obviously, moreover, such an atmosphere can only prevail throughout an organization if the relations between management and workers are consistently good. There are necessarily many factors which influence the attitude of the worker to his or her task, and there is no doubt that working conditions have important psychological as well as physical effects. In recent years there has consequently been increasing recognition of the advantages, from the economic as well as the humanitarian standpoint, of high standards of safeguard against injury, temperature control, ventilation, illumination, and cleanliness, which often go far beyond statutory requirements. Similarly, growing importance is commonly attached to the quality of the canteen, toilet, medical, and recreational facilities provided.

Regardless of what may be achieved in these directions, however, the combination of energy, contentment and loyalty so essential to stable and efficient operation can only be ensured if the workers, in general, feel that they are being adequately and fairly rewarded in proportion to their efforts. This preoccupation with remuneration is both natural and inevitable and the problem of relating earnings to results in such a way that satisfaction is afforded on the one hand without undue inflation of production costs on the other has been the subject of careful study over a long period of years. It is evident, however, from the continued prevalence of industrial disputes, that no generally acceptable solution has yet been found, and the effects of grievances—whether real or imagined—can still be widespread, as recent events have proved.

Very many incentive schemes have been devised and applied in the past with varying degrees of success, and all have some advantages to offer in appropriate circumstances. Such schemes range from straight piece-work to profit sharing, and whereas the former can provide a powerful

stimulus it tends to promote an unduly narrow outlook and may be difficult to apply equitably. For example, where there is a variety of work-pieces that differ considerably as regards complexity and batch size, there is inevitably a tendency to allocate the more intricate parts, and those involving comparatively short runs, to the more highly skilled and adaptable operators, who may thus be placed at a financial disadvantage. With profit sharing, on the other hand, the incentive effects may be so diffused that they no longer command the attention of the individual.

In view of the attention which has been paid to the subject, it might be thought that every feasible method of relating recompense to output would long ago have had extensive practical trials. The results that are being obtained by one large British engineering firm engaged in quantity production from a scheme which possesses various novel features, suggests, however, that there are still fresh possibilities to be explored. Some details of this scheme were given in last week's issue of *MACHINERY*, but because of its apparent importance, we have thought it desirable to draw further attention to its underlying principles.

Under this scheme, it may be recalled, a weekly earnings balance, as it is termed, is determined in accordance with the weekly net sales value of all finished work, including both completed products and spares, and the aggregate of clock hours of attendance for that week. The plan was originally applied to direct production workers only, but as a result of its success, and following representations from various Trades Unions, the scope was subsequently extended to cover all hourly paid employees. With such a scheme, it will be appreciated, all these employees have an interest in ensuring that the maximum contribution is made in the time available. Moreover, they are no longer concerned solely with the outputs obtained from particular machines or other items of equipment, but also with the standard of productivity achieved throughout the organization as a whole. It may be noted, moreover, that precautions are taken to ensure that the earnings balance figures are not influenced by any time spent by production workers—for example waiting time—which is not directly connected with increasing the value of the weekly output.

(Continued on page 1055)

# Producing Components for Box-making and Hardness Testing Machines

**Methods Employed at the Works of Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent**

By P. A. SIDDERS, Chief Associate Editor

EARLIER ARTICLES IN THE SERIES\* devoted to the activities of Vickers-Armstrongs (Engineers), Ltd., Crayford, Kent, have been concerned with the production of components for, and the assembly of, petrol dispensing pumps, which the company make under agreement with Gilbarco, Ltd. An extensive variety of other engineering products is made at the Crayford works, among which may be mentioned the well-known Vickers hardness testers, and box-making machines. The latest addition to the latter range is a 1-in. printer's stitcher, shown in the heading illustration. Production of components for both these types of machines is undertaken in a shop that is separate from that employed for petrol-pump parts, and some of the operations in this shop are here considered.

Many of the components for box-making machines and hardness testers require a number of milling operations, also most of these parts are fairly small. The company has therefore installed a large battery of Fritz Werner controlled-cycle milling machines, types 9.101 and 9.103. When this article was prepared there were 17 of these machines already in use, and a total of 20 will eventually be employed.

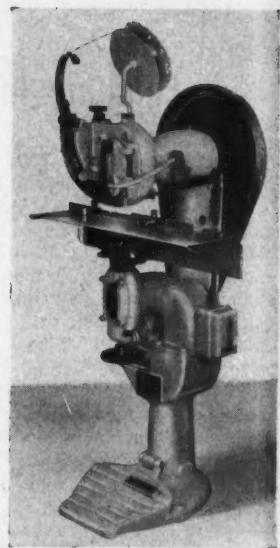
A type 9.103 machine is seen in Fig. 1, and it has a table measuring 49 $\frac{1}{2}$  by 14 in., with an automatic longitudinal traverse of 27 $\frac{1}{2}$  in. There is manual adjustment of the table transversely and vertically through 6 $\frac{1}{2}$  and 13 $\frac{1}{2}$  in., respectively. The 20 spindle speeds range from 22.4 to 1,800 r.p.m., and the 44 feed rates from  $\frac{1}{2}$  to 36 in. per min., with rapid traverse at a rate of 158 in. per min. A main motor of 5% h.p. is provided, and there is a separate rapid traverse motor of 1% h.p.

Of generally similar construction, the type 9.101 machine has a table measuring 35 $\frac{1}{2}$  by 11 $\frac{1}{2}$  in.,

which has automatic longitudinal traverse of 19 $\frac{1}{2}$  in., and manual adjustments transversely and vertically of 5 $\frac{1}{2}$  and 13 $\frac{1}{2}$  in. The 16 spindle speeds range from 45 to 1,400 r.p.m., or from 90 to 2,800 r.p.m., and for each speed range there is a choice of two feed ranges. For the lower speed range, the feed rates are from  $\frac{1}{2}$  to 11 in. per min. or from  $\frac{1}{2}$  to 22 in. per min., and for the higher range, from  $\frac{1}{2}$  to 22 in. per min. or from 1 to 35 $\frac{1}{2}$  in. per min. Rapid traverse, by 1 h.p. motor, is at a rate of 158 in. per min. for all speed ranges, and the main drive motor of 3 h.p.

On machines of both types, milling can be performed automatically in both directions of table travel, with conventional or climb cutting. The cutter spindle can be run in either direction, and the table programme can include one or more phases of feed and rapid traverse, so that intermittent milling and pendulum milling can be carried out. All manual controls are centrally disposed on a panel, and the various motions can be engaged by electrical switches. An automatic spindle brake is provided, and arrangements can be incorporated for relieving the cutter during the return traverse of the table.

Vickers-Armstrongs employ both single-end and pendulum milling, with conventional and climb cutting. For pendulum milling set-ups, it is the company's practice to arrange for the cycle to be started by push-button. The table then moves at rapid traverse rate, and slows to the feed rate when the workpiece approaches the cutter, which is stationary at this stage. The cutter spindle is started automatically, and at the end of the cutting traverse, the machine stops. It is then neces-



\* MACHINERY, 98/1382—14/6/61; 99/202—9/8/61 and 99/502—30/8/61.

sary for the operator to engage the cycle for the other component by pressing the push-button again, so that there is no danger of the table reversing while the second fixture is being loaded. For single-end milling, the table is arranged to return automatically, with the cutter stopped, at the end of the cutting traverse.

#### OPERATIONS ON CLINCHER RAMS

Components milled on the Fritz Werner machines include clincher rams for Vickers-Armstrongs Empire wire-stitching machines. These parts are made from Microlim tool steel, from the English Steel Cor-

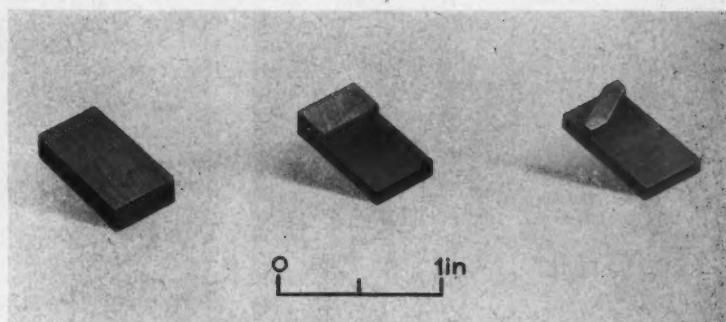


Fig. 2. Clincher rams for wire-stitching machines are made from tool-steel blanks, as seen at the left. Components after the first and second milling stages, on a Fritz Werner machine arranged for pendulum operation, are seen at the centre and right respectively

poration range, and the material is first plough-ground in lengths of 6 in., to a cross-section of  $\frac{1}{2}$  by  $\frac{1}{4}$  in. Next, the billets are plough-ground to 0.436 in. wide by 0.198 in. thick, and are then cut into blanks, 0.815 in. long, by means of a gang of six saws, with the work held in a vice-jaw type of fixture. A blank thus produced is seen at the left in Fig. 2.

Blanks are milled to produce a stepped form, as seen at the centre in Fig. 2, on a Fritz Werner type 9.101 machine. The fixture for this stage is mounted at one end of the table, and at the other end there is a fixture for the next stage, whereby the blank is milled to produce an angularly-disposed key, as seen at the right in Fig. 2. At the first of these two stages, the length of the thicker end of the step form is milled to 0.272 in. and the thickness of the thinner portion to 0.130 in., and each of these dimensions provides 0.012 in. thickness of material for removal at a subsequent finishing operation. The height of the key produced at the second of the milling stages is held to 0.130 in. and the width, to 0.142 in. (measured normal to the long axis), and these dimensions allow 0.012 in. of material for finishing, on the top and side faces.

The fixture for the step-milling operation is seen in Fig. 3, and it will be noted that two blanks, as indicated at A, are milled at one pass. Each blank is located in a transverse slot at one side of the fixture body, and is thrust endwise by the inclined face on a spring-loaded plunger, as at B, so that the opposite end is held in contact with a central datum block C. A finger lever, as at D, projects from each plunger, through a slot in the fixture body, and provides for depressing the plunger to

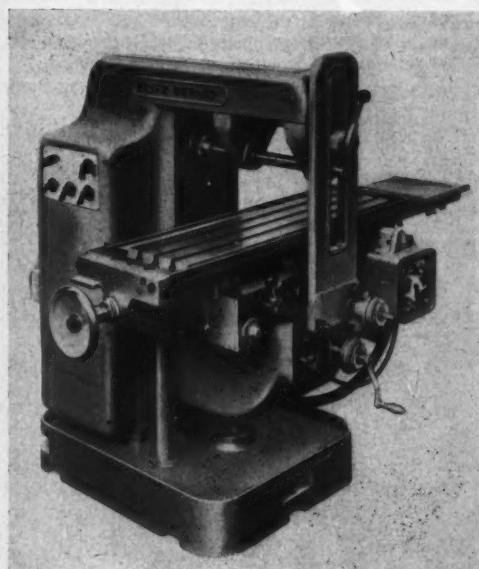
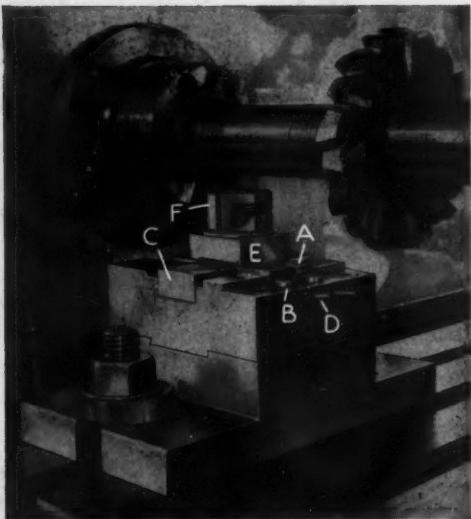


Fig. 1. Fritz Werner type 9.103 automatic cycle milling machine. A large battery of these machines, and of the similar type 9.101, is installed in the Crayford works of Vickers Armstrongs (Engineers), Ltd., for operations on components for box-making and hardness testing machines



**Fig. 3.** Close-up view of the fixture that holds two blanks for the first milling stage in the production of clincher rams. Each blank is moved endwise, into contact with a location face, by a taper face on a spring-loaded plunger, and is secured by a strap clamp actuated by a bayonet-slotted collar

permit unloading and loading. The two blanks are secured by a strap-type clamp *E*, which is thrust downwards, against the pressure of a spring, by means of the collar *F*. This collar incorporates a bayonet slot which is engaged by a pin that projects from the central pillar whereon the clamp, collar and spring are mounted. Flats are machined on the collar so that it can be turned with the aid of a spanner.

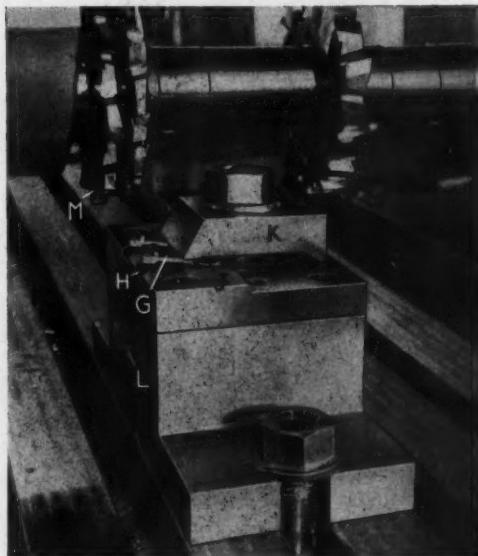
Milling is performed by an alternate-angle, side-and-face cutter, of 5 in. diameter, which has 18 teeth. These cutters are made by Vickers-Armstrongs from English Steel Corporation S.T.Y.R. high-speed steel. Each tooth has 7 deg. top rake, with 12 deg. secondary relief, and the helix angle of the teeth is 10 deg. Climb cutting is employed, at a feed rate of 1½ in. per min., and the cutter is run at 112 r.p.m.

The Fritz Werner machine is arranged for pendulum milling, with reversal of the direction of cutter spindle rotation between successive cutting traverses, and the fixture for the second of the two milling stages is seen in Fig. 4. Partly-machined blanks, from the first stage, are loaded, two at a time, as indicated at *G*. Two grooves

that are an easy sliding fit for the width of the workpieces are milled at the required angle across the fixture body. At one end, each groove breaks into a somewhat deeper slot, as seen at *H*, the slot and groove being at 90 deg. Each blank is loaded into the groove so that it is located endwise between the outer vertical wall of the slot and a peg which projects upwards from the bottom of the groove. One such peg is just visible at *J*. Thus, located, both blanks are secured by a strap-type clamp *K*. At the intersection of each groove and slot, a hole is machined at an angle to provide for the disposal of swarf, and the lower end of one hole is indicated at *L*. Clearance slots are also provided just in advance of each location peg.

Milling is performed by a pair of alternate-angle, 18-tooth, side-and-face cutters *M*, which are made by the company. The spindle speed and feed rate are the same as for the previous operation.

For the next stage, the workpieces are passed to a Fritz Werner machine arranged for single-end milling. At this stage, each blank is milled on the face opposite to the angularly-disposed key, to leave a thin web, and a milled component is seen at *M* in Fig. 5, resting on the baseplate of the fixture employed. The fixture resembles a vice, and has a fixed jaw *P*, to which a location block *R* is secured.



**Fig. 4.** The fixture at the other end of the table to that seen in Fig. 3. This unit holds two partly-machined blanks for the second milling stage on clincher rams for wire-stitching machines

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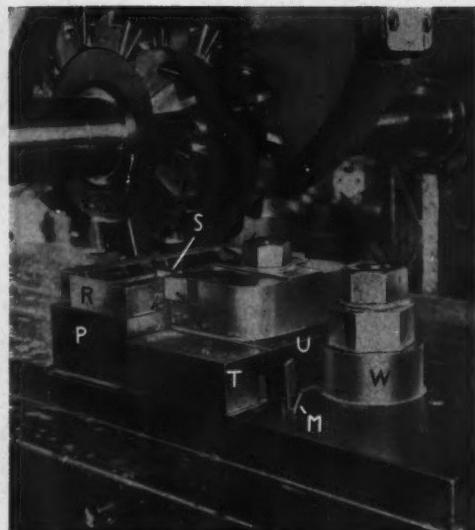


Fig. 5. This fixture holds two clincher ram blanks for the third milling stage, and is mounted on the table of a Fritz Werner machine arranged for single-end milling. A machined workpiece can be seen at **M**

A shallow step is ground in this block to provide a seating for the components, which are milled two at a time. Grooves are machined in the block at the required angle to receive the previously-milled keys. The two work-pieces are loaded, plain side uppermost, with the keys engaging the grooves, and one long side face of each in contact with the narrow vertical face of the step in the location block. A workpiece thus positioned is indicated at **S**.

At either side of the baseplate there are blocks of inverted-L section, as seen at **T**, which serve as guides for the moving jaw **U**. This jaw carries a block with swivelling pads, as at **V**, and by turning the cam **W**, the moving jaw is urged towards the fixed jaw, so that the pads

engage the workpieces. The upper part of the cam is milled to hexagonal section to receive a spanner, and it is mounted on a stout stud fitted to the fixture baseplate.

The cutters employed for milling are of standard English Steel Tool Corporation, Ltd., alternate-angle, side-and-face type, each with 18 teeth. Of 5 in. nominal diameter, these cutters are ground as a pair, and are run at 90 r.p.m., the feed rate being  $1\frac{1}{4}$  in. per min. At this milling stage, the thickness of the workpiece at the end remote from the key is reduced to 0.070 in., and the length of the large end on the side opposite to the key is held to 0.272 in. Both these dimensions allow 0.012 in. of metal for subsequent finishing, and the components are later ground on all faces, including those of the key.

#### OPERATIONS ON KNIFE BLOCKS

Knife blocks for wire stitching machines are made from mild steel bar of  $1\frac{1}{4}$ - by  $\frac{3}{8}$ -in. section, which is cut into pieces  $2\frac{1}{4}$  in. long, the pieces then being plough-ground to 1.375 in. wide by 0.650 in. thick, to produce blanks, as seen at the centre in Fig. 6. These blanks are next subjected to a series of milling operations, and the first two stages are completed at opposite ends of the table of a Fritz Werner type 9-103 machine, arranged for pendulum milling.

The fixture for the first milling stage is seen in Fig. 7, and it holds four blanks, as indicated at **X**. Each blank is loaded into a transverse groove machined in the fixture body, the width of the

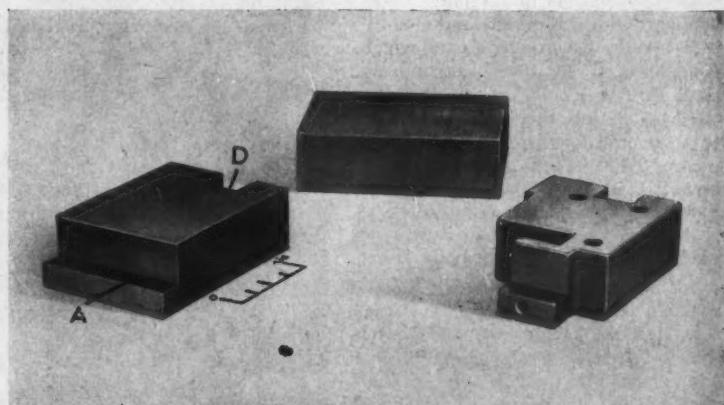


Fig. 6. A blank for a knife block is seen in the centre, and a finished component at the right. At the left is a blank after the first two milling stages in the production sequence have been completed

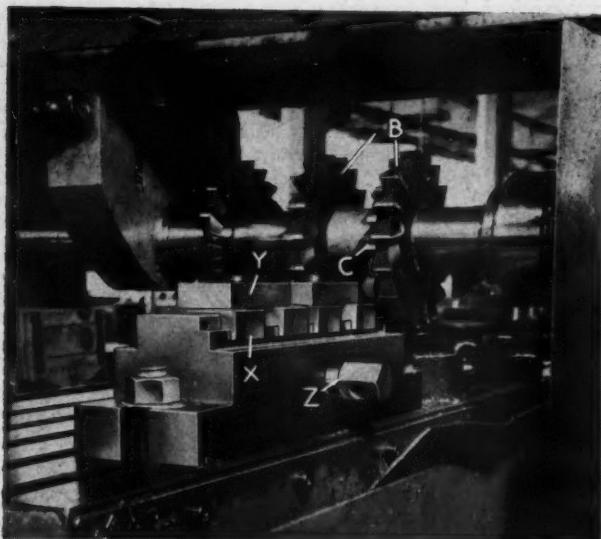


Fig. 7. The set-up for the first milling stage on knife blocks. The fixture holds four blanks, which are secured by cam-operated strap clamps, and it is mounted at one end of the table of a machine arranged for pendulum milling

groove providing an easy sliding fit. Blanks are positioned relative to the fixture by eye, it only being necessary for the machine operator to ensure that there is approximately the same amount of blank material projecting from either side of the body. Blanks are secured in pairs by straddle clamps, as at Y. Each clamp is carried at the upper end of a bolt that passes through the fixture body, between a pair of blanks, and the lower end of the bolt is coupled to a bar, housed in a pocket in the body. This bar, and with it the bolts and clamps, is moved downwards by a cam, which is connected to the hexagon-head shaft Z.

In this fixture, the blanks are milled to an overall length of 1.495 in., and a step, 0.400 in. +0 -0.005 in. deep by 0.250 in. +0 -0.005 in. wide, is machined at one end, as indicated at A in Fig. 6. In Fig. 7, it will be observed that the fixture body is cut

away at one side to clear the step-milling cutter. A gang of four cutters is mounted on the machine arbor, and for this stage, two standard English Steel Tool Corporation side-and-face cutters, of 5 in. diameter, are employed, as seen at B, also a special cutter of similar type for the step. This cutter, which is made by Vickers-Armstrongs, is just visible at C.

Fig. 8 is a view of the fixture at the other end of the table, which provides for milling the slot D, Fig. 6, and the fixture for the previous stage can be seen in the background at the right. The fixture for the slot-milling stage is of vice type, with a main body E of channel form. Transverse grooves, machined in the vertical walls of the channel, receive a plain end-location block at the right, and at the left, a block with a threaded hole to accommodate the clamping screw F. Notches are machined in the upper faces of the blocks to provide clearance for the milling cutter G, which

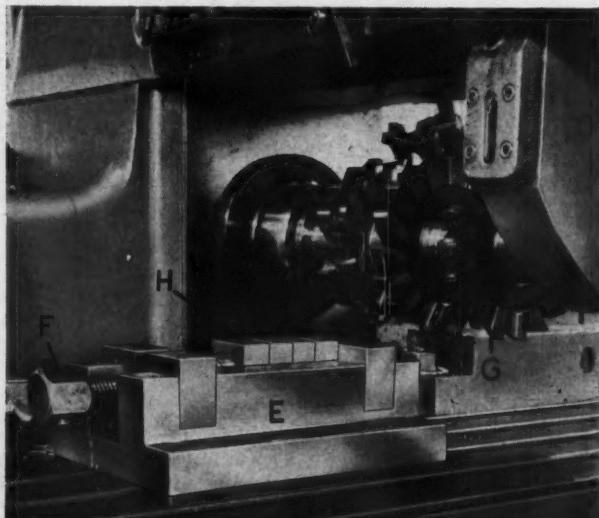
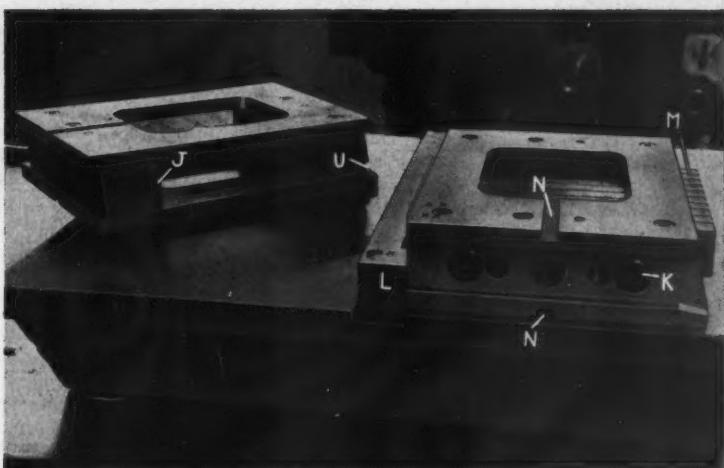


Fig. 8. This vice-type fixture is employed for the second milling stage on knife blocks for the box-making machines built at the Crayford works of Vickers-Armstrongs (Engineers), Ltd.

**Fig. 9.** Cradles employed to hold ten former blanks at a time during milling operations. An empty unit is seen at the left, and the loaded cradle at the right is set against the location bar of the loading fixture, whereby the blanks are positioned correctly relative to datum slots in the cradle



is a standard E.S.T.C. side-and-face type, of 5 in. diameter.

Four blanks are loaded into the fixture, each with the stepped end downwards, as seen at H. The slot in each workpiece is offset in relation to the longitudinal axis, and fouling pins are provided in the bottom of the seating channel to ensure that the four blanks are loaded with their stepped ends orientated correctly. The gap between the vertical walls of the channel form is arranged to provide an easy slide fit for the blanks, which are clamped against the block at the right-hand end of the fixture.

At this stage, a slot is milled in each blank, 0.375 in.  $\pm 0.005$  in. wide by 0.3125 in.  $\pm 0.005$  in. deep. The cutters for both stages have 18 teeth, and are run at 71 r.p.m. Climb milling is employed for both operations, the direction of cutter rotation being reversed between milling traverses, and the feed rate is  $1\frac{1}{2}$  in. per min.

Similar vice-type fixtures to that seen in Fig. 8 are used for subsequent stages that provide for straddle milling steps of differing depths at either side of the small end of each component, and milling a groove in one side of the tongue thus produced, also an adjacent step face, as may be seen on the finished knife block at the right in the group of workpieces in Fig. 6.

#### USE OF MILLING CRADLES

For certain milling operations, the company has developed special work-holding cradles, which can be loaded with components, away from the machine. A typical application of such cradles is for milling former blanks for box-making machines, and in this instance, they provide for milling ten workpieces at one setting. Each blank is a length of rectangular-section steel bar, and at the first

stage for which a cradle is used, the blanks are machined to length and one corner is form-milled to 0.6 in. radius. The other corner at the same end of each blank is form-milled to 0.2 in. radius at the next stage, and both stages are performed on a Fritz Werner type 9.103 machine, which is arranged for pendulum milling.

Three cradles are used, so that one can be loaded with fresh workpieces while the other two are being milled. Cradles are seen in Fig. 9 on the specially-adapted surface plate employed for loading. Each cradle has a body of broad channel section, on which a top plate is located by tenons and secured by screws. A clamping bar is provided at one end, as seen at J in the cradle at the left, and can be moved for a limited distance across the cradle by means of large socket-head screws, as at K.

A bar L, which is located in a groove in the surface plate, has a step machined to a specific depth along one long edge. For loading, a cradle is placed on the surface plate with "X X" identifying marks at one end in line with corresponding marks on the bar, and the side in contact with the vertical surfaces of the bar at either end of the step. Blanks, as at M, are then inserted between the top plate and the body of the cradle, and are moved endwise until they are in contact with the step face of the bar. The blanks are thus set in the correct position in relation to the locating grooves N in the cradle, and are clamped by advancing the socket-head screws.

At the end of a milling cycle, the cradle is removed from the surface plate and is loaded into the fixture at one end of the table, as seen in Fig. 10. It may be observed that the top plate of the

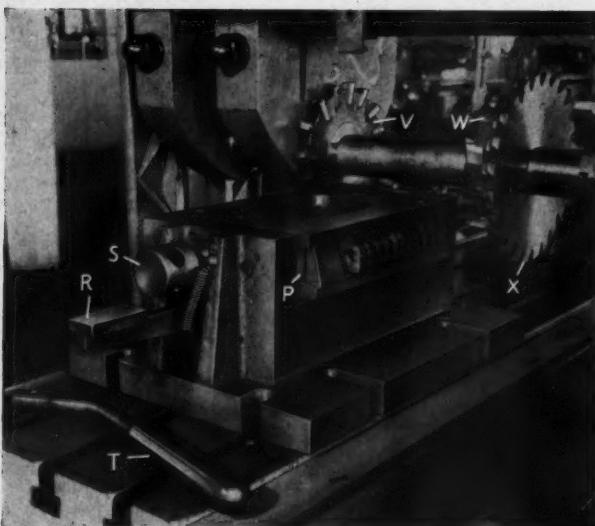


Fig. 10. The fixture at one end of the table of a Fritz Werner machine, with a loaded cradle in position. The cradle is located transversely by a key on the lever *R*. For the next stage, the cradle is transferred to a second fixture at the other end of the table

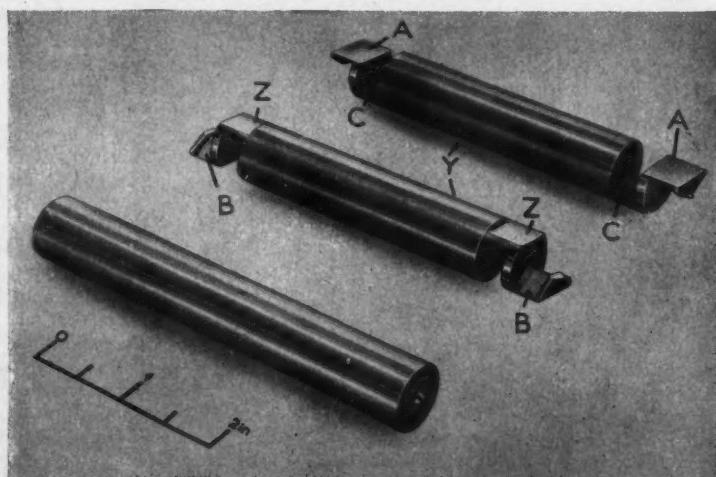
cradle overhangs the cross-members of the body at either side, and each end of the body is machined to leave a transverse rib. The arrangement is such that the rib and overhanging portion of the top plate form a guide channel at each side of the cradle, and when the cradle is loaded into the fixture, the guide channels are engaged with hardened steel strips at each side of the fixture opening, one such strip being indicated at *P*.

A lever *R* is pivoted at one end of the fixture—at the right, as viewed in Fig. 10—and is free to move in slots machined in the fixture body. This lever is positioned on the longitudinal axis of the fixture, and it has an upwardly-projecting integral key towards one end. The lever is spring-loaded so that the

key engages the lower locating groove (*N*, Fig. 9) in the cradle, to position the latter transversely. When the cradle has been thus located, it is clamped in position by means of the screw, which is turned by inserting the removable handle *T* in a cross-hole in the head. The fixture shown has a fouling peg that projects from the hardened steel strip at the right-hand end, and each cradle has a clearance groove milled transversely in one end of the body, as indicated at *U* in Fig. 9. The fouling pin and groove ensure that the cradle is correctly loaded for milling the large radii on the workpieces.

The gang mounted on the machine arbor incorporates a 6-in. diameter Galtona (Richard Lloyd, Ltd.) inserted tooth, side and face cutter, seen at *V*, which is used for milling the plain ends of the blanks at the first stage. At the opposite end of the gang there are three cutters made by Vickers-Armstrongs (Engineers), Ltd., one of which, indicated

Fig. 11. Two axis pins for a hardness testing machine are here seen, with a blank cut from precision ground bar. A sequence of six milling operations is required to produce the two knife edges and flat faces at each end of a component



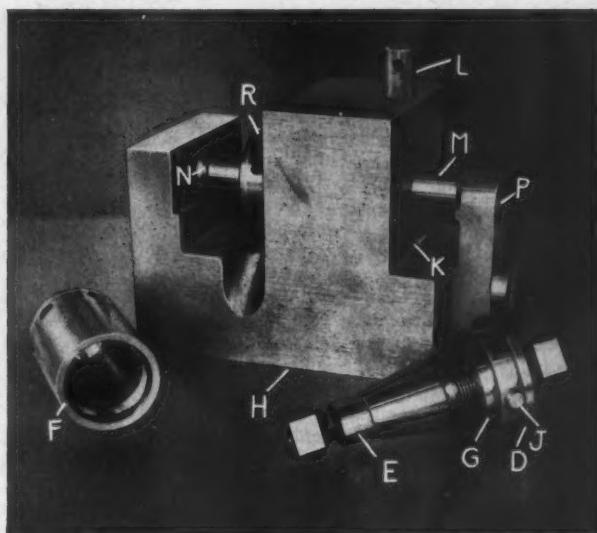
**Fig. 12.** For milling, the axis pin blanks are gripped in collet-type holders, one of which is seen dismantled in the foreground, with a milled component inserted in the body. A special fixture, as seen at the rear, is used for loading, to facilitate location and clamping of the workpiece

at W, serves for milling the other ends of the blanks to give the required overall length. On the inside of the cutter W, there is an interlocking form cutter which produces the 0.6-in. radius, and on the outside, a 7/8-in. diameter form cutter X for milling the 0.2-in. radii on the blanks at the second stage, when the cradle has been transferred to the fixture at the other end of the machine table.

Conventional milling is employed for both stages, the cutters speed being 58 r.p.m., and the feed, 1% in. per min.

#### OPERATIONS ON AXIS PINS

Axis pins for the hardness testing machines built by Vickers-Armstrongs (Engineers), Ltd., are made from precision-ground bars of case-hardening mild steel, which are supplied finished to 0.625 in. diameter, +0, -0.005 in. Blanks are machined from the bar as seen in the foreground in Fig. 11, and each is 4.250 in. long, +0, -0.001 in., with a hemispherical pip at each end. These blanks are then subjected to a series of milling operations to produce groups of flat faces, that form opposed knife edges, at both ends of each workpiece, as seen on the components at Y. The operations comprise:—(1) Mill a pair of flat faces, as at Z, to 0.260 in. from the axis of the component; (2) mill a pair of flat faces, as at A, to 0.180 in. from the axis of the component and parallel to the first pair; (3) mill a pair of flat faces, as at B, and associated shoulders, at an included angle of 55 deg. to the faces A; (4) mill a pair of flat faces, and associated shoulders, at an included angle of 110 deg. to the faces B to form one pair of knife edges; (5) mill a pair of flat faces, as at C, at an included angle of 45 deg. to the faces Z; and (6) mill a pair of flat faces at an included angle of 90 deg. to the faces C to form the second pair of knife edges. For these operations, the turned blanks are mounted in cylindrical holders, incor-



porating collet-type jaws, and once a blank has been gripped in a holder, it is not removed until the complete series of milling stages has been carried out. Four identical holders are used, and two are loaded while cutting operations are performed on blanks held in the other two.

#### COLLET-TYPE WORK-HOLDERS

Each work-holder has two principal components, which are shown separated in the foreground of Fig. 12. The body D is machined to form the collet jaws, and is seen with a milled workpiece E lightly gripped by the jaws. A cap F is screwed on to the body, and has an internal conical surface to close the collet jaws on to the workpiece. An accurately ground step in the bore engages a mating register surface G on the body, to maintain the two members in correct alignment.

A fixture H is employed to facilitate locating and clamping the workpieces in the holders, and is seen with a holder and blank in position. With the holder body and cap assembled, but not tightened, a blank is inserted in the holder, and the complete assembly is loaded into a bore in the fixture. A peg J on the holder body is engaged with a slot machined in the fixture, and the end of this slot is seen at K. The holder is thrust into the fixture bore until the flange at one end of the body bears against the face of a counterbore, and is thus positioned endwise. A loose pin L is now passed through a hole in the fixture and engaged with a hole in the holder, at 180 deg. to the location

peg *J*. This pin serves to retain the holder, also to prevent excessive strain on the peg *J*, when the cap is tightened.

The blank *M* is then pushed through the holder until its end face abuts a hardened pad *N*, which has a central hole to clear the pip at that end of the blank. An arm *P*, with a slot to clear the pip at the other end of the blank, is next swung into the position shown to ensure that the blank is held in contact with the pad *N*. With the blank thus located in the required axial setting relative to the holder body, the cap *R* is tightened with the aid of a tommy bar, the fixture being cut away at each side to permit greater movement of the bar.

#### MILLING OPPOSED FLAT FACES

All milling operations are performed on Fritz Werner machines, and stages (1) and (2) are carried out on a machine arranged for single-end milling, with the fixture seen in Fig. 13. The fixture body is bored and counterbored to provide two seatings for the work-holders, and is split at each end so that it can be closed on to the holders by tightening nuts on studs. A holder, with a blank clamped in position, is first loaded into

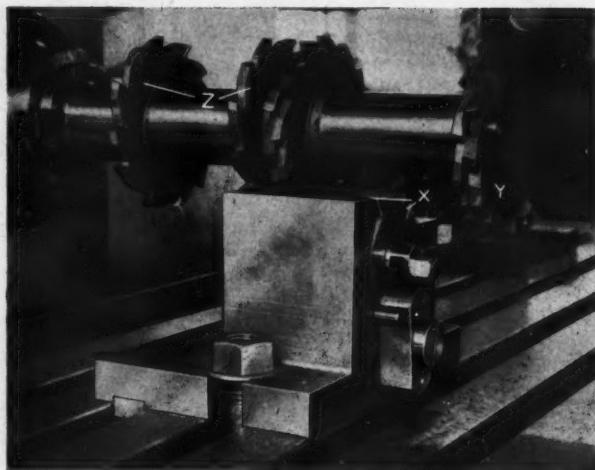


Fig. 14. The fixture for milling the outer pair of knife edges and associated shoulders. A blank in its holder is located successively in two positions at 110 deg. After this stage, the holder and blank are transferred to a similar fixture at the other end of the table, and the inner knife edges are milled

the seating *S* for stage (1), and after one machine cycle, it is transferred to seating *T* for stage (2), a holder with an unmachined blank being loaded into the seating *S*. The heights of the seating axes from the base of the fixture are arranged to give the required dimensions from the flats to the work axes.

At both positions, correct angular location of the work-holders is ensured by the engagement of the pegs (*J*, Fig. 12) with slots milled in the fixture body. The slot for the first seating is seen at *U*, and that for the second seating, at 180 deg. to the first, at *V*. Swinging arms, as at *W*, are provided at one side of the fixture, to ensure that the flanges of the holders are held in firm contact with the faces of the counterbores in the fixture seatings, these faces serving for axial location, as on the loading fixture. When both holders have been set angularly and axially, they are clamped by tightening the nuts at the ends of the fixture.

The ends of the blanks project on either side of the fixture body, and the flats on both components are produced by straddle milling during the same cutting traverse. Standard E.S.T.C.

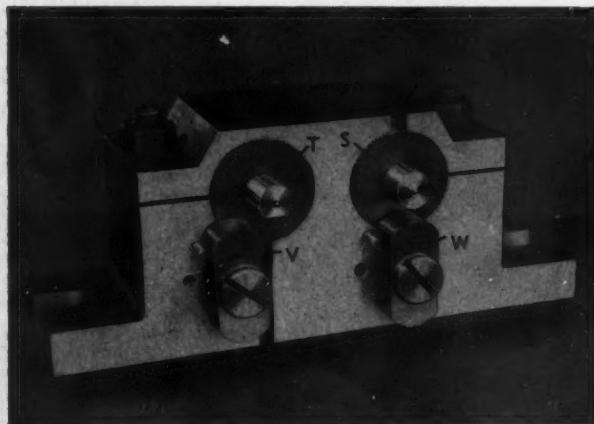


Fig. 13. This fixture supports two holders and blanks, while two flats are milled on each piece. A blank is first milled at the right-hand station, and then transferred to the left-hand station, where it is located at 180 deg. to the first setting

side-and-face cutters are used, and each is of 4-in. diameter with 12 teeth. The cutters are run at 112 r.p.m., and the table feed rate is 1 in. per min. It will be apparent that the flats produced at both positions of the fixture extend for the same distance from the ends of the blanks, and are longer than are required. The excess length of each flat is removed during the milling of the knife edges.

#### MILLING KNIFE EDGES

Stages (3) and (4) of the operation sequence are performed with the work holder mounted in the fixture seen in Fig. 14. This fixture has a seating for only one holder, but is generally similar in construction to that already described. For axial location the holder flange is held in firm contact with the face of a counterbore, by a swinging arm. Angular location is determined by two slots, as at X, which are at an included angle of 110 deg., and the fixture body is split at one end and closed on to the holder by tightening a nut. During one machine cycle, a flat, and associated shoulder, at each end of the blank is milled. The work holder is then set in the other angular position, and the other two flats and shoulders are milled to complete the 110-deg. knife edges. Milling is performed by four of the six cutters in the gang mounted on the machine arbor. The outer cutters, as at Y, machine the shoulders, and the inner cutters, the knife edge faces.

The fixture is mounted on one end of the table of a Fritz Werner machine, which is arranged for climb milling with reversal of the spindle between cutting traverses. When stages (3) and (4) have been completed, the holder and blank are transferred to a fixture at the other end of the table, which provides for stages (5) and (6). This fixture is generally similar to that already described, but has angular location slots set 90 deg. apart. The cutters indicated at Z are used for this stage. All cutters of the gang are of alternate-angle side-and-face type, with 12 teeth, and those for the knife edge faces are of 4 in. diameter. A spindle speed of 112 r.p.m. is employed, and the table feed rate is 1 in. per min. After stage (6) has been completed, the holder is returned to the loading fixture for removal of the completely-milled workpiece, and is then reloaded with a fresh blank.

Fritz Werner milling machines are sold in this country by Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2.

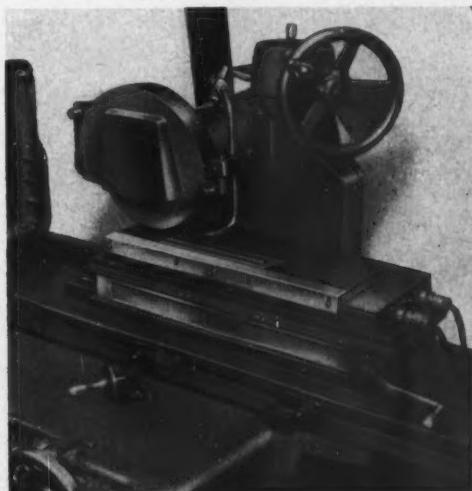
Certain other operations on components for box-making machines at the Crayford works of Vickers Armstrongs (Engineers), Ltd., will be considered in a further article to be published in MACHINERY.

## Electroforce Electrostatic Chuck

George H. Alexander Machinery, Ltd., 82-84 Colehill Street, Birmingham, 4, are the selling agents in this country for the electrostatic chuck, developed by Electroforce Inc., Fairfield, Connecticut, U.S.A., which was described in MACHINERY, 95/155—29/7/59.

One of these chucks has been acquired by Precision Grinding, Ltd.—a subsidiary company of George H. Alexander Machinery, Ltd.—and is employed at their Mitcham, Surrey, works for holding a variety of components of different non-ferrous metals, for surface grinding operations. In the figure, the chuck is shown mounted on a conventional magnetic chuck on the table of a surface grinder, for holding an 8-in. long tungsten-copper electrode for spark machining, which measures 0.190 in. wide by 0.050 in. thick. The electrode is ground to limits of  $\pm 0.0002$  in. for thickness.

This chuck has a working surface of 18 by 6 in., and the overall thickness is  $2\frac{1}{2}$  in. The body incorporates a number of  $1\frac{1}{4}$ -in. thick ceramic blocks, which extend from front to back, and a film of epoxy resin, with a thickness of 0.0008 to 0.001 in., covers the entire working surface. Gripping



An Electroforce electrostatic chuck is here shown set up on a surface grinder at the works of Precision Grinding, Ltd., Mitcham, Surrey

power is provided by electrostatic charges of opposite polarity generated on the contact surfaces of the chuck and the work by a 110-volt a.c. supply, provided by a compact power unit which forms part of the equipment. Since the electrostatic charges are returned through the body, workpieces which are to be held singly should make contact with an end or side stop. When a number of small parts is to be gripped, the individual pieces should be so arranged that they make contact with each other, and some of them with a stop. Small pieces, such as the electrode mentioned earlier, are positioned between back-up strips, as shown.

Because the static charges are applied only to the contact surfaces, it is essential that the work and the chuck should be thoroughly clean and dry before the current is switched on. To remove condensed moisture from the surfaces before the workpieces are loaded on to the chuck, they are heated to a few degrees above room temperature, for about 10 to 15 min., in an electrically-heated box, known as a Dri-Box, which can be mounted on a wall close to the grinder. A quantity of liquid solvent is applied to the chuck for cleaning the working surface, and is then wiped off, usually by means of a paper tissue, which is used once and discarded. Next, a quantity of dielectric fluid is poured on to the working surface, and the components may then be removed from the Dri-Box and placed in the grinding position. When the power supply is turned on, by means of a toggle switch at the right-hand end of the body, the dielectric fluid is squeezed out from the space between the work and the chuck, and serves to exclude air from any pockets in the contact surfaces. Two different dielectric fluids are supplied with the chuck, that with the higher viscosity being intended for use when workpieces with individual surface areas of less than 1 sq. in. are to be held, and the other, of lower viscosity, for holding parts with larger surface areas.

When grinding is in progress, dielectric cutting fluid in the form of a highly-refined mineral oil of low viscosity is delivered to the work by a motorized pump, and is then passed to a reservoir by way of a filter of the paper bag type. Fluid may be directed into either side of the filter, so that one paper bag may be removed and replaced, when required, without the need for stopping the pump.

Because only electrostatic charges are employed for gripping purposes, the workpieces can be readily removed from the chuck when the current is switched off, and there is no residual magnetism. The force applied by the electrostatic charge is such that when cast iron components are held,

some carbon particles may be pulled from the contact surfaces, with the result that the gripping action is reduced. In such instances, when the workpiece has been cleaned and dried, it is mounted on the chuck, and the power is switched on and then off. It may be necessary to repeat this procedure several times in order to obtain sufficient gripping force for holding the component securely.

Because the gripping force is not reduced with the workpiece thickness, very thin parts may be held securely by the chuck, and components made from materials such as plastics, and ceramics may also be gripped if a metallic coating has been applied to the contact surfaces.

Care must be taken to avoid damaging the epoxy resin coating on the working surface, for instance by dropping workpieces or tools on the chuck, and burrs should be removed from the contact surfaces of components. When the coating has become worn, or in the event of damage, it is removed by grinding. A fresh coating is then applied and ground to the required thickness.

## High Temperature Thermocouples

Thermocouples suitable for detecting high temperatures in industrial and research applications are to be marketed by Honeywell Controls, Ltd., Greenford, Middlesex. Materials used are combinations of tungsten, rhenium, rhodium, molybdenum, iridium and platinum, and the maximum temperature ratings of the thermocouples range from 3,000 to 4,200 deg. F. Types are available for both oxidising and reducing environments. For a maximum temperature of 4,200 deg. F., a thermocouple using tungsten versus tungsten/26 per cent rhenium is employed. Thermo-electric output of such a thermocouple is nearly three times as great as that of the tungsten-rhenium thermocouple which it will largely supersede. Moreover, the temperature/e.m.f. curve approaches more closely to the linear in the 2,000-4,000 deg. F. range. Improved uniformity of wire is obtained due to the tungsten-rhenium alloy being more homogeneous, and errors are claimed to be less.

Another of the new thermocouples uses platinum/30 per cent rhodium versus platinum/6 per cent rhodium, and is intended for continuous use at temperatures up to 2,732 deg. F., and intermittent service at temperatures up to 3,272 deg. F. The new alloy type of thermocouple does not suffer from excessive grain growth, vaporization, contamination and other disadvantages of existing platinum-rhodium thermocouples.

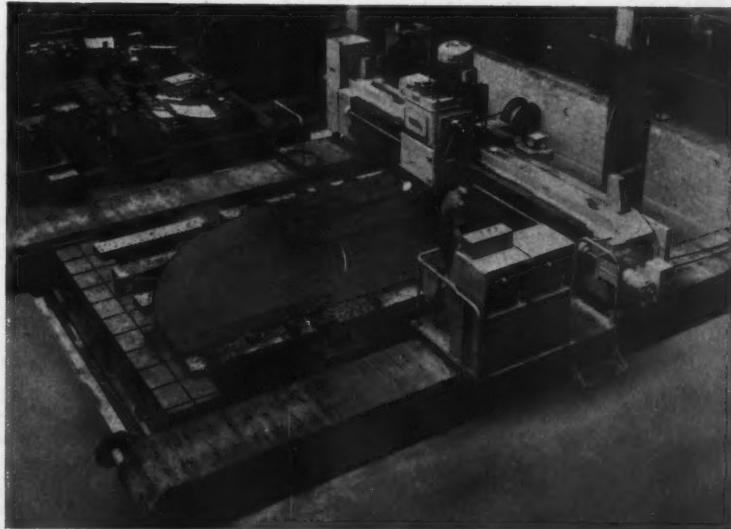
## Wadkin Type TCD.2 Tape-controlled Co-ordinate Drilling Machine

THE TYPE TCD.2 TAPE-CONTROLLED CO-ORDINATE DRILLING MACHINE shown in the illustration has been built by Wadkin, Ltd., Green Lane Works, Leicester, and is installed in the works of Richardson Westgarth (Hartlepool), Ltd., for drilling, tapping and counterboring numerous holes in large condenser plates for nuclear power station plant. Brass and steel plates up to 20 ft. by 14 ft. are handled on this machine, and as many as 12,000 holes of 1 in. diameter may be drilled in each plate in a variety of complex patterns, on a fully-automatic cycle. Interchangeable 4-spindle attachments which have different centre distances can be mounted on the drilling head. Alternatively, a single-spindle milling attachment can be fitted, and plates are normally handled four at a time.

A stack of plates to be drilled is supported by four heavy cast iron tables, which have T-slotted top surfaces. Saddles at the ends of the cross-rail which carries the drilling head, have built-in re-circulating roller chain units to ensure smooth sliding movements with low frictional force, and the entire assembly is traversed on hardened steel guideways incorporated in bed members at the ends of the work-tables. Of fabricated steel construction, each bed member has an overall length of 32 ft. 6 in., and is built up from four sections.

Traversing movements are imparted to the cross-rail assembly by two 3-in. diameter screws and re-circulating ball nuts, and there are special slipper arrangements which ensure that the unsupported length of the traversing screws does not exceed 10 ft. Drive to the traversing

screws is taken from a motor of  $1\frac{1}{2}$  h.p. through a gearbox which incorporates electro-magnetic clutches. This assembly is mounted at the centre of the cross-rail to ensure a balanced drive. A second motor and gearbox assembly of similar design and capacity is mounted at the right-hand end of the cross-rail for imparting movement to the drilling head in the transverse direction. Rapid power traverse at the rate of 60 in. per min. is provided for the cross-rail and spindle head for coarse positioning, and speeds of 30, 3 and  $1\frac{1}{2}$  in. per min., are automatically brought into use during the setting cycle. Provision is made for synchronizing the traversing screws for the longitudinal movement, and for equalizing backlash, and the cross-rail and the drilling head are always moved in the same direction for final setting. Interlocking steel guards of the roller shutter type extend for the full length of the bed-ways to protect the guiding surfaces, and the traversing screws and nuts. Nylon wipers are provided at both sides of



This Wadkin type TCD.2 tape-controlled machine has been installed in the works of Richardson Westgarth (Hartlepool), Ltd., for drilling numerous holes in large condenser plates

the drilling head for cleaning the traversing screw for the cross movement. The distance between the tops of the tables and the cross-rail is 14 in.

#### THE DRILLING HEAD

Drive to the drilling head is taken from a 30-h.p. flange-mounted motor, through a gearbox which gives 9 spindle speeds from 97 to 1,033 r.p.m. Six feeds from 0.004 to 0.030 in. per spindle rev. are provided for drilling, and change gears can be supplied for tapping pitches ranging from 6 to 14 t.p.i.

The machine can be set for drilling or tapping by positioning a lever on the spindle head and a switch on the control unit, and the spindle drive and down feed movement are automatically engaged at the beginning of the cycle by built-in electro-magnetic clutches. At the end of a drilling operation, the feed clutch is automatically de-energized by a limit switch on the head, and a second clutch is engaged which causes the spindle to be rapidly returned to the starting position. The positioning cycle is then automatically initiated. At the completion of a tapping operation, the spindle is automatically reversed and run at a higher speed by the action of other electro-magnetic clutches, for withdrawing the tap from the work. When the spindle has been brought to the top of its travel, the clutch for the reversing drive is automatically de-energized.

The maximum vertical movement is 12 in., and down feed is transmitted by a screw and a re-circulating ball nut. A torque control unit is provided which restricts the maximum thrust that can be applied to the drill to 10,000 lb. The gearbox is pressure lubricated by a built-in pump, and there is a cooling system for controlling the temperature of the lubricant that is delivered to the electro-magnetic clutches.

#### THE POSITIONING SYSTEM

The positioning system has been specially developed by Airmec, Ltd., High Wycombe, Bucks., and enables co-ordinate settings of the cross-rail and drilling head to be obtained automatically from information provided on punched tape, or manually by means of dials. For each axis, there are two positioning units connected to the traversing screws, and two control units are provided, which are mounted on the operator's platform at the right-hand end of the cross-rail.

Two similar tapes are prepared on key-board type punching machines, usually by different operators, and they are fed into separate readers

built into the control units. The control units and the positioning units for each axis are interlocked electrically. When positioning is being carried out, one control unit and one positioning unit for each axis determine the traverse movement, and the other control unit and positioning unit serve to measure the actual travel. The interlocking system is such that unless similar signals are transmitted by both positioning units for one axis at the end of a setting operation, the drilling cycle is not started. In this way, the risk of producing spoiled work due to faulty preparation of the tapes, failure of relays in the control units, or faulty reading of the coded information, is avoided. For positioning under hand control, the required co-ordinate dimensions are set up on two series of dials on each control unit. Again, the drilling cycle is not started at the end of the positioning cycle if different dimensions have been accidentally set up on the dials in each set. When positioning has been completed, the drilling head is automatically secured to the cross-rail, and the cross-rail saddles to the bed, by hydraulic clamps, and the drilling cycle is then started.

Provision is made for disconnecting the positioning units from the electrical system, and the cross-rail and drilling head can then be traversed under the control of push-buttons built into a portable unit, for example when the machine is being set up, and for milling operations. The different traversing speeds available can be brought into use, as required, by means of a selector switch on the portable control unit. Separate controls for the down feed and return movements, and for "inching" the driving gears to facilitate changing spindle speeds, are provided on the drilling head. Electrical equipment is housed in a cabinet at the left-hand end of the cross-rail, and the cable for the power supply is carried on a spring-loaded drum.

The overall width of the machine is 25 ft., and the length, 34 ft. 6 in.

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**PARLOX SELF-LOCKING NUT.** Parr Equipment Co., Ltd., 20 Avonmore Road, Kensington, London, W.14, have introduced the Parlox self-locking nut of the nylon insert type. The steel body is cold formed and is of 35 to 45 tons tensile strength, and the nylon lock, which is expanded into a recess in the reinforced fabricated boss, is positively keyed to prevent rotation. A steel reinforcement is provided in the nylon, which has radiused edges free from flash, and a torque equalizing joint is claimed to level out the difference, between "first time on" and "subsequent removal" restraining torque.

## Some Set-ups on Centec Automil Production Milling Machines

ON THE AUTOMIL AUTOMATIC-CYCLE production milling machine built by Centec Machine Tools, Ltd., Hemel Hempstead, Herts., longitudinal traverse is imparted to the work-table for a maximum distance of 14 in. by an air-hydraulic cylinder, and the steplessly-variable cutting feeds obtainable range from 1 to 400 in. per min. Fast approach to bring the work close to the cutter at the beginning of the machining cycle, and rapid return when milling has been completed, are at the rate of 420 in. per min. The machine may be used to advantage for pendulum milling, and separate controls are provided that enable different cutting feed rates to be obtained for each direction of the table traverse, as may be desirable for climb and conventional milling. Cross traverse of the saddle, for a maximum distance of 5 in., is normally effected



**Fig. 1.** Close-up view of a Centec Automil automatic-cycle production milling machine set up for cutting an oil groove in a component for a motor car automatic transmission unit

by hand, and the knee has a vertical adjustment of  $7\frac{1}{4}$  in. Six spindle speeds are obtainable, which may range from 85 to 1,400, or from 170 to 2,800 r.p.m. Full details of the Automil machine were given in *MACHINERY*, 98/33—4/1/61. A vertical-spindle milling attachment has recently been made available for the machine, to which down feed can be applied by an air-hydraulic system, as part of the automatic working cycle.

In Fig. 1 is shown an Automil which has been installed in the Letchworth, Herts., works of Borg-Warner, Ltd., for plunge milling a partly-circular oil groove with a  $1\frac{1}{4}$ -in. dia-



**Fig. 2.** This close-up view shows a Centec 8-in. diameter air-operated indexing table set up on an Automil machine on which six slots are milled in an end face of a crowned gear component

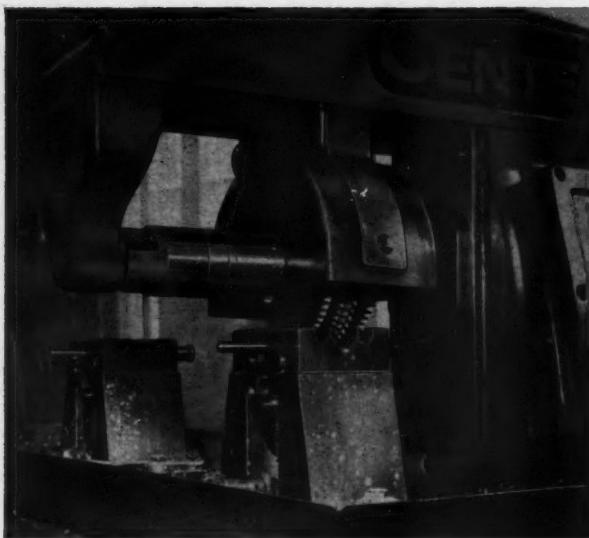


Fig. 3. At this pendulum milling set-up on another Automil machine, a pair of spindle components is produced from a single blank at each cycle

meter by  $\frac{1}{8}$ -in. wide Woodruff keyway cutter, in the  $1\frac{1}{8}$ -in. diameter bore of a cast iron component for a motor car automatic transmission unit, as seen at A. An unusual feature of this particular machine is that cross traverse is imparted to the saddle by a double-acting air cylinder. The component is held in the fixture on the table by two hand-operated toggle clamps. There is a tongue which extends into the bore of the fixture and engages with a slot in the face of the casting, for locating the latter for angle. When loading has been completed, a push-button is pressed to initiate the automatic milling cycle. The spindle drive is then started, and the saddle is traversed towards the column by the air cylinder, into contact with a stop which positions the work in an axial direction in relation to the cutter. At the end of this movement, an air valve is operated, with the result that the table is traversed to the right, at the pre-set feed, for performing the milling operation. When milling has been completed, the table is moved in the opposite direction, to bring the workpiece bore central with the cutter, and the cross-slide is then rapidly traversed to its starting position, and the cutter spindle is stopped to complete the cycle. The cutter spindle is run at a speed of 195 r.p.m., and the cycle time for the operation is 20 sec.

Fig. 2 is a close-up view of another Automil

milling machine, equipped with a Centec 8-in. diameter air-operated indexing table, as set up at the Birmingham works of Hardy Spicer, Ltd., for milling six equally-spaced slots in an end face on a crowned gear component, on a fully-automatic cycle. With the work-table of the machine in the extreme left-hand position, an air valve is operated by hand to start the working cycle, and the component is then gripped by an expanding mandrel built into the indexing table. Next, the main table is traversed to the right for milling the first pair of slots in the piece. At the end of the cutting stroke, the table is rapidly returned to its starting position, and the indexing table is then turned through 120 deg. This sequence of operations is repeated for milling the second and third pairs of slots, and when the table has once more been brought to the left-hand position, it is stopped, and the expanding mandrel is released in readiness for unloading.

A third Automil machine, fitted with two air-operated fixtures and arranged for pendulum milling on a fully-automatic cycle, has been supplied to Hollands & Blair, Ltd., 98 Cherry Road, Croydon, Surrey. A close-up view of the cutters and fixtures is given in Fig. 3. At this set-up, two V-shaped notches and two flats are milled in a  $\frac{3}{16}$ -in. diameter blank of En. 8 steel, and at the same time, the latter is severed by a slitting saw incorporated in the cutter gang, to produce two spindle components at a single cycle. A cutting feed of 12 in. per min. is employed, and components are produced at the rate of 500 per hour. The fixtures are operated by separate pedal-type valves, and because the machine is arranged for pendulum milling, one fixture can be unloaded and loaded while milling is in progress on another piece in the second fixture.

**NEW AEI IGNITRONS FOR PULSE-WELDING.** Two new types of ignitrons, specially designed for pulse-welding applications, have been introduced by AEI, Ltd., Crown House, Aldwych, W.C.2. Designated BK 300B and BK 302B, the ignitrons are of coaxial construction and the current flows from the anode to the cathode and then by way of the valve wall to a cathode flange terminal at the top of the unit. This coaxial current flow is claimed to provide a magnetic shield which eliminates arc deflection caused by high peak currents.



## Vibratory Finishing

By WILLIAM E. BRANDT\*

**VIBRATORY FINISHING**, which has been developed comparatively recently, has proved to be a rapid, efficient, and versatile process. The workpieces are embedded in a mixture of medium, compound, and water, and are subjected to controlled gyratory vibration in specially designed equipment. By accurate regulation of machine variables—including duration of cycle, frequency, and amplitude—and the proper choice of medium and compound, the nature and extent of the finishing action obtained can be varied over a wide range.

Heavy scale, burrs (Fig. 1), or flash can rapidly be removed; radii can be formed accurately to the required dimensions; and surface roughness can be reduced to obtain low micro-inch finishes. In addition, parts may be cleaned, coloured, or burnished. Any combination of these processes, as indicated by Fig. 2 and 3, for example, can be performed without removing the workpieces from the machine. Of particular importance, moreover, is the fact that the nature of the work motion enables internal and shielded surfaces (Fig. 4 and 5) of parts to be deburred or finished, together with exposed areas.

The constant acceleration of the parts, medium, and compound, and changes in direction of their relative motions, results in a scrubbing action that operates on all portions of the load simultaneously, with the result that cycle time is reduced to a minimum. Work containers can be almost com-

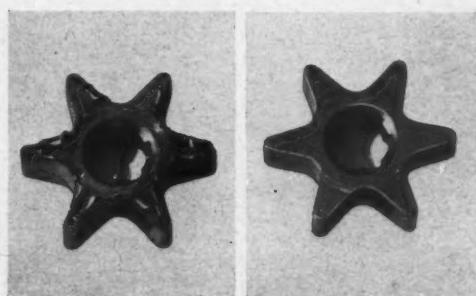
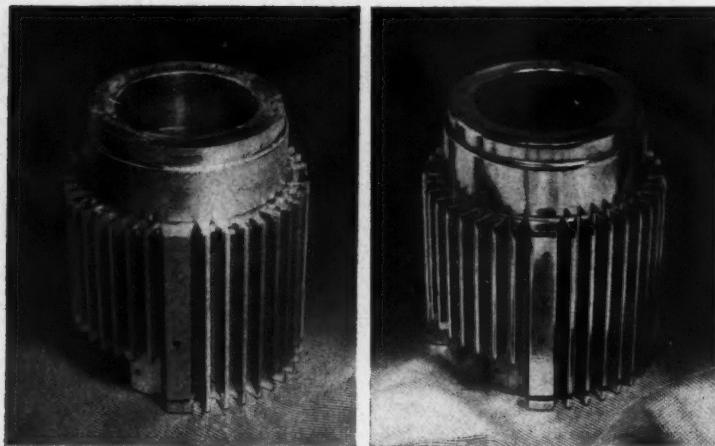


Fig. 1. Carbon-steel sprockets before and after being de-burred in a 6-cu. ft., vibratory-finishing machine in a 75-min. cycle. Because of the number processed, one piece is de-burred every 2 sec.

\* Pangborn Corporation, U.S.A.



**Fig. 2.** A comparison of these parts will show the extent of combined de-burring, rounding of edges, and colouring performed on aluminium electric motor frames processed in a vibratory-finishing machine

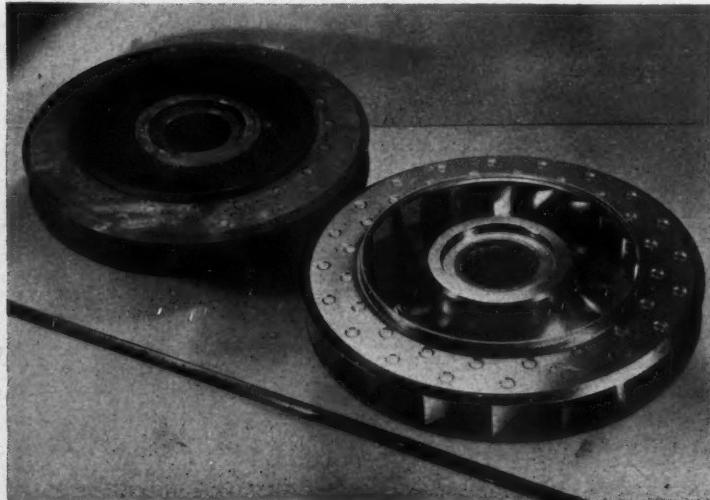
pletely filled and are left open to permit in-process inspection. Another useful effect of the constant vibratory motion is to impart to the work load partial weightlessness by reducing the action of gravity. Since only a fraction of the load in the container is ever allowed to act on the parts at any one time, the process is applicable even to the finishing of delicate and fragile components for electronic valves or textile machinery.

Vibratory finishing can be applied to a very wide range of metal parts, whether ferrous or non-ferrous, and whether cast, forged, stamped, machined, or pressed. In the heading illustra-

tion, a steel transmission part is seen being inspected after de-burring treatment in a Pangborn vibratory gyrator. Fused aluminium-oxide medium was used with an abrasive compound.

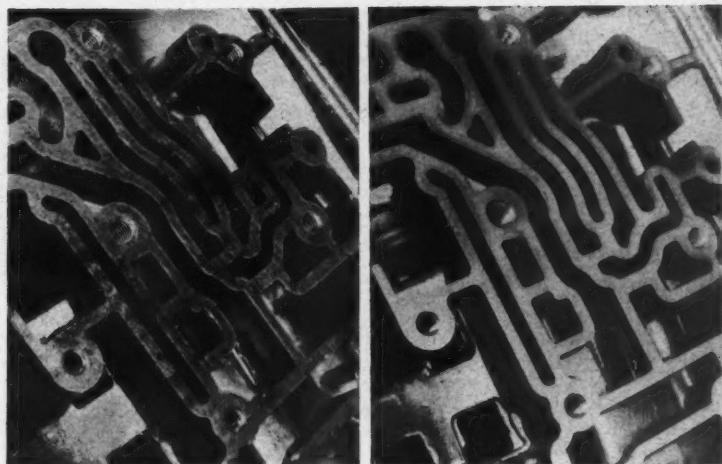
The process is equally applicable to fairly large and small parts. A section of a large stainless-steel rectifier roll, of 24 in. diameter, is seen in Fig. 6. This part is here shown as it appeared after vibratory finishing in an 18-cu. ft. machine. It was held in a fixture and processed for 2 hours in fused aluminium-oxide medium and compound.

When parts are processed while held in fixtures, the normal cycle time is reduced by 50 per cent if the fixtures are supported on the stationary frame of the machine, or externally. If, however, the fixtures are supported on the rim of the vibrating container—as is usual—the cycle time is further reduced by 50 per cent. The reason for these reductions is that there are, in effect, two separate additive vibrations. It will readily be



**Fig. 3.** Stainless-steel turbine wheel before and after being vibratory-finished for descaling, surface improvement, and burnishing. The combined descaling and cutting cycle occupied 1 hour, and burnishing was completed in 15 min. The part was held in a fixture and fused aluminium oxide and compound were used

**Fig. 4.** Both shielded and exposed surfaces of a die cast transmission part are effectively finished in a 20-min. vibrator cycle. Here, portions of the part are shown close-up before and after processing



apparent that the phenomenon can be used to advantage, especially for processing stainless steels, titanium, and other hard metals. For example, it was found possible to improve micro-inch readings on forged and machined turbine blades of very hard stainless-steel by 100 points in 30 min. by using a fixture held on the work container.

Aircraft camshafts are deburred and their surfaces improved, 39 at a time, in a 12-min. cycle, while held in the fixture seen in Fig. 7. The shafts are snared into place between spring-loaded centres mounted on the two side-plates. Provision is made for adjusting the fixture to accommodate camshafts of various lengths. The unit is designed to fit an 18-cu. ft. capacity Pangborn machine.

A manufacturer recently submitted metal bulbs  $\frac{3}{4}$  in. long by  $\frac{1}{8}$  in. diameter, with a neck opening of  $\frac{3}{32}$  in. diameter and  $\frac{1}{8}$  in. long for interior scale removal by vibratory processing. Despite the obvious difficulty, a test run was attempted. When a bulb was cut open after 25 min. in the

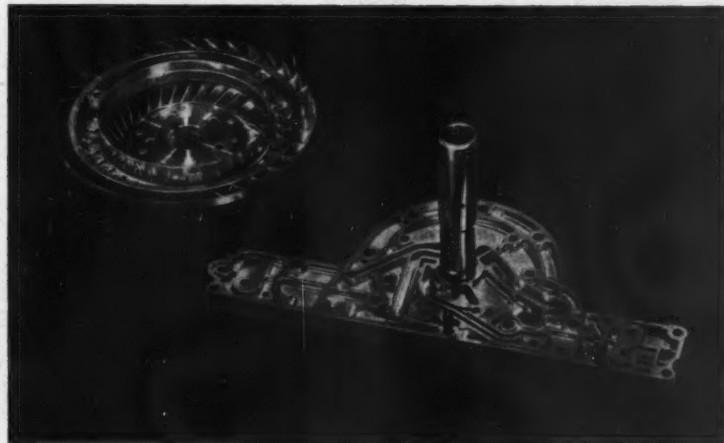
vibrator, it was found that an excellent interior finish had been obtained.

Many firms using vibratory gyrators have automated the machines as well as work-handling facilities to suit their particular parts and production arrangements. In conveyorized production lines some companies process castings on a 2 or 3 shaft basis in 3-, 5-, and 10-min. time cycles without stopping the machines, except once per shift for flushing out abrasive sludge.

#### MACHINE FREQUENCY AND AMPLITUDE VARIATION

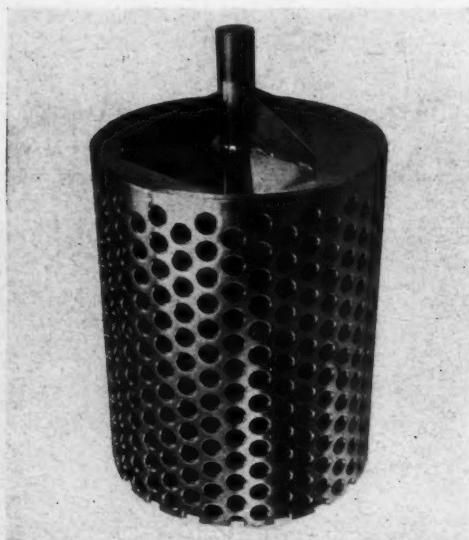
For effective vibratory finishing there are four requirements, namely: (1) suitable machinery,

**Fig. 5.** Effect of vibratory finishing on other die cast motor vehicle transmission parts with elaborate and shielded contours. De-burring and finishing were performed with fused aluminium oxide and compound, again in a 20-min. cycle

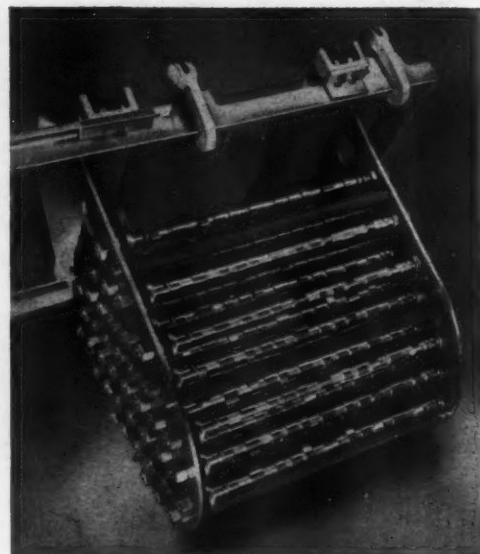


(2) the correct medium, (3) the proper compound, and (4) an understanding of the technique. The primary consideration in the design of any vibratory-finishing machine is the type of work action that is produced. A pounding or impinging motion would be quite unsuitable if a fine finish was desired. Straight-line vibration would technically prevent the production of smooth and lustrous surfaces. The motion of the individual pieces in the composite load relative to one another must be so controlled as to produce a positive, uniform, gyratory scrubbing action, with complete absence of hammering or peening.

To ensure the necessary versatility for producing a variety of effects, a vibratory-finishing machine should be provided with means for varying amplitude as well as frequency. It will be appreciated that the combination of amplitude and frequency required for maximum stock removal may be entirely unsuitable for fine finishing or burnishing operations. Facilities for varying frequency and amplitude are also necessary when especially fine finishes and/or burnishing are required on delicate high-precision parts where distortion must be avoided. Although amplitude will in fact increase with frequency up to the limit of the effective operating range, a variation of frequency alone



**Fig. 6.** This 24-in. diameter stainless-steel work-piece was held in a fixture and processed with fused aluminum-oxide medium and compound in an 18-cu. ft. machine



**Fig. 7.** Adjustable fixture with 29 camshafts in position for vibratory finishing. The shafts are deburred, and all surfaces are improved. The operation is completed in 12 min. on an 18-cu. ft. capacity machine

will not suffice. Within the effective frequency range for an operation, amplitude increase is negligible. A vibratory-finishing machine that allows for increase or decrease of both amplitude and frequency, while in operation, has a much wider range of application than one with fixed amplitude or frequency.

There are, of course, many other machine features to be considered. Available horse-power must be adequate for operation but at the same time economy must be studied. Suitable machine design can contribute materially to reduction of maintenance, convenience, simplicity, compactness, quiet operation, and long life.

The construction of vibratory gyrators made by the Pangborn Corporation is illustrated in Fig. 8. In this equipment, the work container is vibrated by means of weights mounted eccentrically on a short heavy-duty shaft supported on a floating platform in closely spaced bearings. Removal or addition of weights affords one means of varying the amplitude of vibration. Two sets of air cushions, inter-connected through a manifold, are employed for the suspension of the floating platform from the rigid machine structure. Variation

of the air pressure to the manifolds provides a second method of adjusting amplitude. An annular type flexible coupling of moulded rubber absorbs vibration between the drive and the floating shaft during operation. By varying the effective diameter of the driving pulley, the vibration frequency can be adjusted within a ratio of 2 to 1. For unloading, the work container can be tilted through 120 deg.

#### FUSED ALUMINIUM-OXIDE CHIPS

Although for some applications other media are preferred, the accepted all-purpose medium for vibratory finishing is fused aluminium oxide. Depending on the purpose of the finishing operation, the action of this medium can be regulated from fast cutting, through any reduced degree of metal removal, to burnishing (Fig. 9) merely by use of the proper compound. With mixtures of media of appropriate sizes, the workpieces can remain in the container until a series of finishing operations has been completed. There is no necessity for unloading and reloading of work and media. Only the compounds are changed in a multiple phase run, the load being rinsed between cycles. Even after the media have been so completely "loaded" that they have only a burnishing action, a quick rinse in a special detergent will restore the original sharpness.

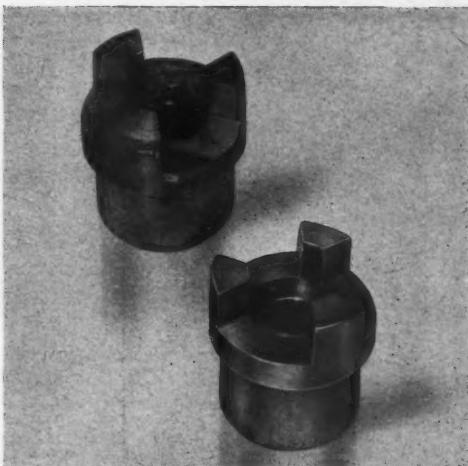


Fig. 9. Couplings before and after vibratory finishing with a 40-min. de-burring cycle and a 10-min. colouring cycle, using fused aluminium-oxide media and compounds

Fused aluminium-oxide media are now produced with a fine crystalline structure. When they are correctly made, the breakdown of these media is even and extremely slow. Also the fracturing off of minute pieces has virtually been eliminated. The media are available in a wide selection of accurately graded size ranges. In this connection it should be pointed out that selection of the wrong medium size or combination of sizes can prevent the desired results from being obtained. Pangborn fused aluminium-oxide media are shown in Fig. 10.

For certain applications, abrasive pre-forms, in shapes such as those illustrated in Fig. 11, may be required. These shapes consist of bonded and kiln-fired aluminium-oxide grain or silicon-carbide grain or grain mixtures, or a combination of both. Ceramic triangles (Fig. 12) also offer advantages for some operations. Although it has little or no cutting ability in itself, this long-life medium has a textured surface that serves as a carrier for certain abrasive and burnishing compounds. In one application, die-cast parts are finished in a

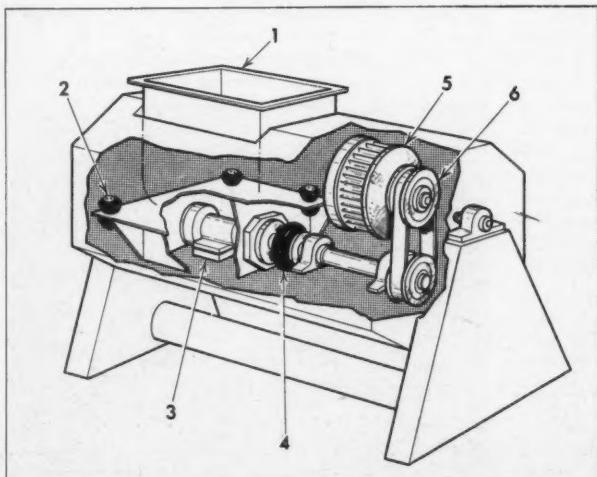
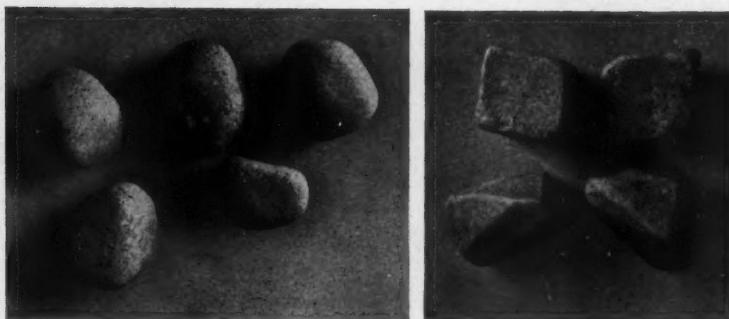


Fig. 8. Constructional features of a Pangborn vibratory-finishing machine include: (1) work container, (2) air cushions, (3) adjustable shaft-mounted eccentric weight, (4) annular coupling, (5) motor, and (6) variable-diameter pulley



**Fig. 10.** Fused aluminium-oxide chips are the most commonly used all-purpose media, for vibratory finishing. Here two forms of these media are shown, both of which are available in a wide range of accurately graded sizes

15-min. cycle in an 18-cu. ft. capacity Pangborn vibratory gyrator, charged with ceramic triangles and compound.

Steel media, as seen in Fig. 13, are sometimes used with appropriate compounds for deburring, cutting, colouring, or burnishing. The shapes employed include double-pointed pins, slightly flattened and truly spherical balls, cones, balcones, diagonals, and ovals. Whereas soft-steel shapes (with abrasive compounds) are used for cutting and de-burring, casehardened or through-hardened steel media enable colouring and burnishing to be carried out.

#### COMPOUND FOR VIBRATORY FINISHING

Regardless of machine design, and choice of media, no vibratory-finishing operation could be carried out successfully in the absence of a suitable compound. Whether the operation involves cleaning, de-scaling, de-burring, radiusing, grinding, fine finishing, colouring, or burnishing, without a compound with the necessary properties the workpieces would be discharged from the container chemically unclean, and impregnated with abrasive.

Just as the word compound indicates the presence of a multiplicity of materials, the purposes of the compound are manifold. If, for instance, an abrasive compound is used in conjunction with an abrasive medium, the abrasive material in the compound would obviously serve only to expedite the grinding or polishing action of the medium. This action may be important in any given application, but it is only one of many functions a compound must perform.

Every compound should possess cleaning properties. Not only must the workpieces be kept

clean, but the abrasive medium, which is constantly shedding microscopically fine particles during use, must be kept sharp, with open pores. A compound must also impart "rinsability" to the working solution. Both detergent action and rinsability are often supplied, in part, by synthetic detergents that are compatible with the complete compound formula. If the workpieces are of ferrous metals, anti-corrosion agents must also be incorporated in the composition of the compound.

In any event, a compound must have the ability to hold in suspension any microscopically fine particles originating from either the metal or abrasive during processing. These particles would otherwise be rubbed into the workpieces, making it impossible finally to obtain virgin metal colour, clear lustre, or chemically clean surfaces. Unclean surfaces, of course, would interfere with subsequent operations such as machining, welding, brazing, soldering, buffering, or plating. The soil-suspending agents employed may be soap, carboxy-methyl cellulose, or other synthetic materials.

Certain cushioning and/or lubricating agents are required even in abrasive compounds. They may range from foam of low density to lubricants



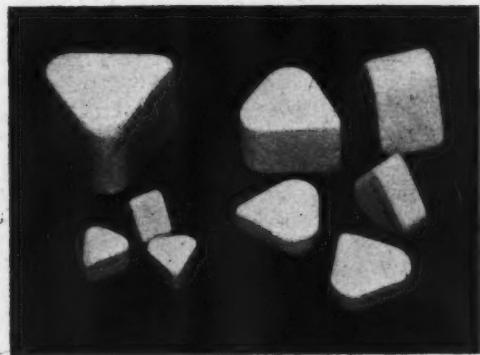
**Fig. 11.** Abrasive pre-forms, which are used for certain special applications, are made from bonded grains of aluminium oxide and/or silicon carbide

which will control cutting action to any desired degree. Water conditioners must be supplied, and brightening agents are often present in the form of phosphate-salt combinations. Finally, buffering or inhibiting, shelf life, and other properties, must be considered in formulating a compound.

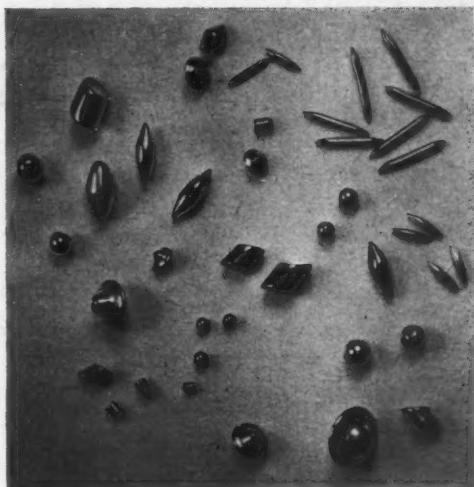
Because of the differences between metals, and the differences between the nature of the various operations, a wide selection of abrasive compounds is required. Frequently, non-abrasive cutting or deburring compounds are used. In these circumstances, the abrasive medium alone performs the actual grinding, while specific agents in the compound expedite the cutting action to a substantial degree. There are also short-cycle cleaning or bleaching compounds for various metals or alloys. It is important to appreciate that compounds of this type that are intended for use with certain ferrous metals might "burn" or blacken copper alloys, and vice versa. Burnishing compounds are specifically made for that purpose and cannot be expected to provide for de-scaling, just as de-scaling compounds cannot provide for burnishing.

A different de-burring, cleaning, or burnishing compound, however, is not necessarily required for each class of metal or alloy. There are so-called all-purpose de-burring or polishing, all-purpose cleaning, and all-purpose burnishing compounds which will give very satisfactory results with any metal or alloy, and are especially applicable to vibratory finishing. Nevertheless, special compounds are often necessary.

The chemical compositions of many abrasive compounds are much the same. The differences



**Fig. 12.** Although these ceramic triangles are essentially non-abrasive, their textured surfaces serve as a carrier for certain abrasive and burnishing compounds



**Fig. 13.** Soft steel media in these shapes are used for both cutting and de-burring, whereas case-hardened or through-hardened media, in the same forms, are effective for colouring and burnishing

lie in the type of abrasive material and the size or size range of the particles. If it is desired to achieve much grinding, de-burring, radiusing, or tool-mark obliteration on hard metals, a very hard, tough, and coarse abrasive material is needed to sustain cutting for a sufficient time before the abrasive breaks down and only a polishing action is obtained. If less cutting is required on such hard metals, a finer grit of the same abrasive material in a compound of the same chemical composition is used. For ordinary ferrous metals (including the softer stainless groups) normal aluminium-oxide grain will suffice, whereas the tougher and more expensive white aluminium-oxide grain is required for the very hard alloys.

Similarly, to perform work on softer alloys, such as those of aluminium and zinc, a softer abrasive, such as silica, in various grit sizes, is needed. If all that is required is quickly to reduce micro-inch readings on relatively smooth surfaces, a fairly fine size range of abrasive will suffice.

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**EXPORTS OF MACHINERY**, other than electric, during the period up to August 31 this year reached a total of £552,505,733, as compared with £478,078,396 for the same period last year. Principal markets during this year have been Canada (£34,745,402), Australia (£34,146,315) and U.S.A. (£30,605,569).

## A Transistorized Light-operated Counter

By E. G. GLAYSHER

Until recently, counting of small switchgear components produced in the press shop of Allen West & Co., Ltd., Brighton, was carried out by weighing, or by recording the number of press strokes. With either method there were inaccuracies, and a counting instrument was therefore designed which is actuated by the components, as they are produced. A typical tool incorporating the sensing head employed for detecting the passage of the components is shown in Fig. 1. This particular tool provides for piercing, cropping and forming small connection washers.

The head is sufficiently small to be installed as part of the tool, and it carries a light-sensitive transistor. A light beam, from a standard lens-ended lamp, is directed on the transistor, and components passing through interrupt the beam, causing breaks in the current produced. Pulses from the sensing head serve to operate a switching type of transistor, which, in turn, actuates a

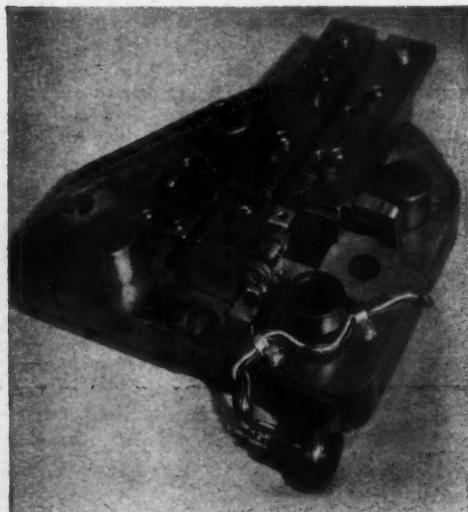


Fig. 1. A typical tool, employed for the production of small connection washers, with a sensing head for detecting the components as they are produced

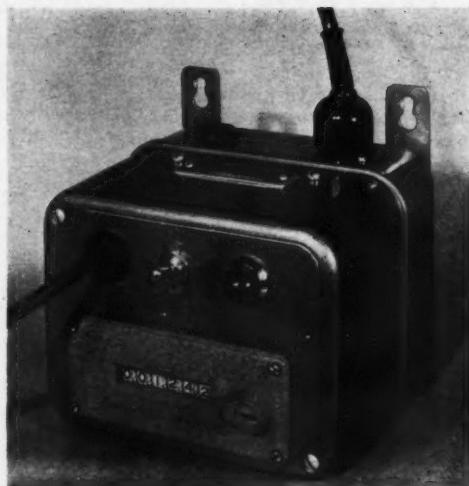


Fig. 2. A switching transistor, electro-mechanical counter, clip-in circuit board, power pack, fuses and an indicator lamp are housed in a standard starter case which can be mounted in any desired position

standard, key-reset, electro-mechanical counter. The switching transistor and the counter, together with a clip-in circuit board, power pack, fuses, and an indicator lamp, are housed in one of the company's standard starter cases, as seen in Fig. 2, which can be mounted in any desired position.

The installation has the advantage that there are no moving parts to wear, except in the counter. When the sensing head is employed with a tool of the blanking and piercing type, it is usually more convenient to count the pieces between the openings in the scrap strip.

It should be mentioned that the counter here described was produced for use in the company's works only, and that at the present time it is not being made available commercially.

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ELECTRICITY sent out on public supply during August totalled 7,742 million kilowatt-hours.

# Producing Gas Turbine Components

**Examples of the Methods and Equipment Employed by Rolls-Royce, Ltd., Derby**

By P. A. SIDDER8, Chief Associate Editor

PRODUCTION OF CERTAIN COMPONENTS for gas turbine engines at the Derby works of Rolls-Royce, Ltd., was described in an earlier article, in MACHINERY, 99/348—16/8/61. For example, reference was made to milling facings on thrust reverser boxes for Avon engines, machining thrust reverser rear seals for Conway engines, and profile milling nozzle box outer casings for Conway engines. Operations on certain other engine components are here considered, also a standardized indexing fixture base developed by the company.

Fig. 1 shows the outlet duct for the thrust reverser of the Avon engine fitted to the French Caravelle air liner. This component is weld-fabricated from Nimonic sheet and strip material, and it incorporates bearing pads for the cascade



Fig. 1. Outlet duct for the thrust reverser fitted to the Rolls-Royce Avon gas turbine engine. The component is weld-fabricated from Nimonic

vanes that direct the flow of hot gases from the main engine outlet duct when the thrust reverser is in use.

There are four banks of bearing pads at each side of the component, as indicated at A, and the faces of these pads are milled on a Cincinnati No. 4 horizontal machine, fitted with a special extension milling head built by Rolls-Royce, Ltd. Prior to the milling stage, a part-cylindrical flange B

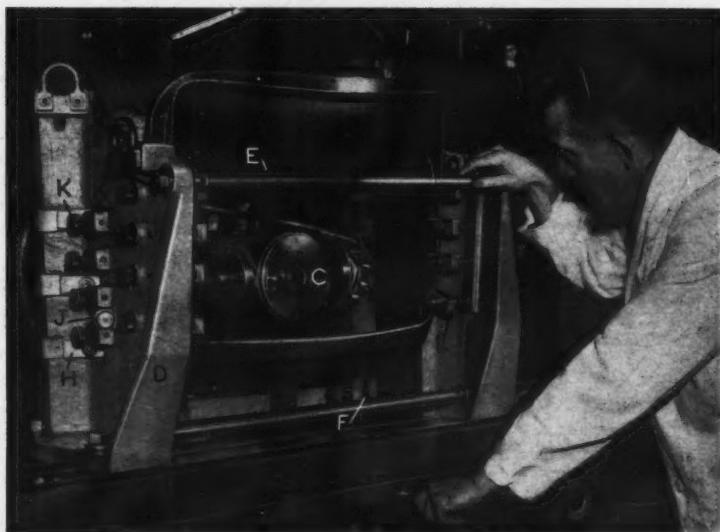
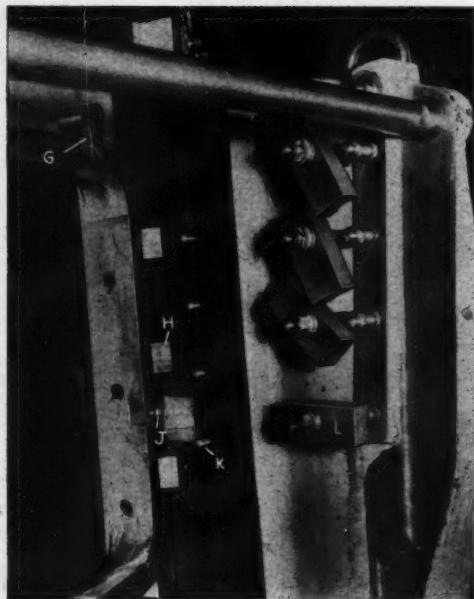


Fig. 2. Set-up on a Cincinnati No. 4 horizontal milling machine for facing internal bearing pads in the Avon thrust reverser outlet duct. The machine is fitted with a special Rolls-Royce head



**Fig. 3. Close-up view of the fixture for the outlet duct showing the clamps and steady screws at one side, also one of the two sliding location pins**

is machined and a series of holes is drilled in this flange.

A general view of the set-up on the Cincinnati machine is given in Fig. 2, and the special Rolls-Royce head is seen at C. The cutter spindle of this unit is mounted in roller bearings, and is driven by bevel gearing from a shaft at 90 deg., which is coupled to the main spindle of the machine. Mounted on the face of the column, the Rolls-Royce head can be swung through 360 deg. about the axis of the machine spindle, and the distance from the face of the column to the axis of the cutter spindle in the head is 16 in. For milling the bearing pads, the head is set with the cutter spindle horizontal.

At this set-up, the outlet duct is supported in a fixture, which has a cast-iron main frame D, of U-form in plan. The side members of the frame are braced by steel tie bars, as at E, and a large rectangular opening is provided in the transverse wall. A

facing round this opening, on the side remote from the machine column, is machined to form a part-cylindrical seating with which the flange B, Fig. 1, is held in contact. There are three strap-type clamps below the opening, as seen at F in Fig. 2, to thrust the lower long side of the flange against the seating, and the upper long side is secured by three hook-bolts, one of which may be seen at G in the close-up view, Fig. 3. Each short side of the flange is engaged by three strap clamps, as at H in Fig. 2, the end of one of these clamps being similarly identified in Fig. 3.

The workpiece is located by two angularly-disposed sliding pins, one of which enters one of the larger holes in each short side of the flange. In Fig. 2 the outer end of the pin at the left-hand side of the fixture is seen at J, and the inner end of the pin at the other side of the fixture is similarly indicated in Fig. 3, which is a close-up view with the work removed.

At each side of the fixture there are two groups of four steady screws, as seen at K in Fig. 2. (The inner end of one of the screws at the other side of the fixture is seen at K in Fig. 3). After the outlet duct has been located and clamped by the members so far described, the steady screws are advanced into contact with it. Four strap-type clamps, mounted on the inside face of each side wall of the fixture, are then swung inwards to engage the internal side face of the outlet duct,



**Fig. 4. Oil tank for the Rolls-Royce Tyne gas turbine engine. Made from steel, the component has an internal facing that forms a metal-to-metal seal**



**Fig. 5.** Close-up view of the grinding wheel and extension arbor fitted to a Wadkin router for finishing the seal face of the Tyne oil tank

and tightened. One of these clamps can be seen in the working position at *L*, Fig. 2 and 3, and in the latter illustration, the remaining clamps of the set have been withdrawn to clear the work.

A Galton facing cutter of 4 in. diameter, with 8 inserted teeth, is used for milling the bearing pads, and is run at 33 r.p.m. The table is fed transversely at a rate of  $\frac{1}{2}$  in. per min. and milling is performed in two roughing stages and a finishing stage. When roughing, 0.040 to 0.060 in. of metal is removed (per stage), and approximately 0.010 in. is removed by the finishing cut. The cutter teeth have 10 deg. front rake, 20 deg. axial rake, 15 deg. radial rake and 0.075-in. nose radius. It has been found that it is essential to keep the teeth sharp for milling Nimonic.

Fig. 4 shows the oil tank for the Tyne gas-

turbine engine, which is weld-fabricated from Fortiweld steel. The irregularly-shaped internal facing *M* must be finished to provide a smooth surface, for a metal-to-metal seal, and the distance from the facing to the face of the flange *N* must be held to 10.5 in. within a tolerance of 0.001 in. On early experimental engines of this design, the facing was scraped by hand to fit the mating component, but when the Tyne went into production, a more economical method had to be found.

#### ROUTER ADAPTED FOR FACE GRINDING

A Wadkin articulated-arm routing machine, which has a range of five spindle speeds for the routing head, is now employed for the operation. The head is of standard Wadkin stator-rotor type, and speeds of 6,000, 9,000, 12,000 and 18,000 are obtainable by means of a frequency-changer system. A lower speed has been provided, to meet Rolls-Royce requirements for other duties, by making use of the primary 50-cycle supply, current being supplied by way of a transformer whereby the primary voltage is reduced to a value to suit the routing head windings.

The low speed, it may be noted, is not used for grinding, for which a spindle speed of 6,000 r.p.m. is suitable. A 10-in. long extension arbor is fitted to the spindle of the routing head, as indicated at *P* in the close-up view, Fig. 5, and carries a 3-in.



**Fig. 6.** Finish grinding the seal face of a Tyne oil tank on a Wadkin articulated arm router. Movement of the routing head is controlled by a masking plate mounted above the component

diameter, Norton taper cup wheel, of specification 36A60-K5VBE.

Fig. 6 shows a grinding operation in progress on the Wadkin machine, which is equipped with a special table of box type, with a tilting and indexing sub-table mounted on one end face. A fixture to hold the oil tank is secured to the main box portion of the table. This fixture was designed and made by the machine shop staff from available material. On the circular base *R* there are light-alloy columns, as at *S*, which support a ring *T*. The component is seen at *U*, and the bottom face rests on a seating on the fixture base. To ensure that the mounting conditions are the same as when the component is assembled in the Tyne engine, the bottom face is pulled down on to the seating by 40 socket-head screws, which pass through countersunk holes, as seen at *V* in Fig. 5. The flange *N*, Fig. 4, is supported on pillars, as at *W* in Fig. 6, and is secured by clamps mounted on the ring *T*.

To control the movements of the router head during grinding, a mask plate is mounted on the ring *T*, and is indicated at *X* in Fig. 5 and 6. This ring is cut away at intervals to clear the

clamps for the flange of the component. During grinding, the operator moves the router head by means of the handle-bar control, and maintains a shoulder *Y*, Fig. 5, at the upper end of the extension arbor, in contact with the internal profile of the mask plate. With the equipment described, the total time for grinding the facing on an oil tank, including loading and unloading, is 4½ hours.

#### STANDARDIZED INDEXING AND TILTING JIG BASES

From a study of the components considered in this and the preceding article, it will be appreciated that it is necessary to machine numerous holes at various positions and different angles in many gas-turbine parts. To obviate the need for large numbers of indexing and tilting fixtures and jigs, Rolls-Royce, Ltd., have designed and built standardized bases, each with a platen that provides for mounting a jig, and incorporating arrangements for indexing and tilting. A typical drilling set-up for a gas-turbine component, seen in Fig. 7, provides for machining a number of angularly-disposed holes in the magnesium alloy air intake for a Tyne engine. The component *A* is mounted in a drum-type jig *B*, secured to a standardized base, and an auxiliary plate-type jig *C* is secured to the work-piece to guide the drill. By means of the base, the complete assembly of work and jigs is located at the required angle for drilling the holes at the centre of the upper surface of the component, and can be readily reset for drilling holes at different angles around the periphery. In addition to the base shown—of which nine are now in use at the Derby works—the company has developed a simpler non-tilting indexing base, with the platen surface in the vertical plane, and a smaller indexing and tilting unit, arranged for air-clamping of the moving members.

Fig. 8 is a view from the rear of the set-up in Fig. 7, and shows the construction of the base. The main members are the bed *D*, the tilting housing *E*, the platen *F* and the plinth *G*. Plinths of various thicknesses are available to enable work to be set at a convenient height. The bed *D* is of U-shape, and the two uprights are connected by a transverse shaft, whereon the housing *E* pivots. Of box construction, the latter member can be tilted through 90 deg. by rotating the large hand-wheel *H*, and settings can be made with reference to a quadrant plate *J*, which is calibrated in ½-deg. divisions. A second quadrant plate, as seen at *K*, Fig. 7, can be secured to the housing by screws and dowel pins, and is provided with hardened steel location bushes. This second quadrant plate is designed to suit the requirements of the component that is to be machined and the bushes,



Fig. 7. Drilling inclined holes in an air intake for the Tyne engine. The magnesium alloy component is mounted in a jig on a Rolls-Royce indexing and tilting base



**Fig. 8.** View, from the rear, of a Rolls-Royce standardized indexing and tilting base, showing the handwheels for rotating the platen and associated housing. The work is located in one plane by bushes fitted to the jig secured to the platen, and in the other, by bushes in a quadrant plate bolted and dowelled to the housing

which are arranged on two pitch circles, are engaged by either of two lever-operated sliding plungers *L*. Two plungers are provided to permit positive location of the housing at smaller angular steps than would be possible with a single plunger and row of bushes. At the inner end, each lever is machined to form a clevis that embraces the outer end of the location plunger. A pivot pin passes through the arms of the clevis and the plunger, and the ends of the arms are machined to serve as cams for withdrawal of the plunger.

The platen is mounted on a shaft that passes through the housing, and can be turned through 360 deg., by means of the smaller handwheel *M*. T-slots are machined in the top surface of the platen, and the periphery is calibrated in 1-deg. divisions. On the housing is mounted a bracket *N*, wherein slide lever-operated location plungers. These plungers engage hardened steel bushes fitted to the fixture or jig used with the base, to provide for accurate location. Again, two plungers are provided, and the bushes are located on different

pitch circles, to permit indexing through small angles. There is provision for clamping the platen and housing when they have been located in the required positions, and counterweights, as at *P*, can be fitted to the housing to offset the out-of-balance mass of the work and jigs, when the platen is inclined.

### Westinghouse "Molecular" Slide Rule

Westinghouse Research Laboratories, U.S.A., have developed an electronic device known as a molecular slide rule, which comprises a thin slice of silicon semi-conductor crystal of very small dimensions, and has logarithmic characteristics. The slide-rule function is obtained by re-arranging the internal structure of the solid-state semi-conductor by electrical means.

An electric current fed into a semi-conductor junction gives a voltage across the junction which is proportional to the logarithm of the current. An input of two currents into two junctions produces a voltage which is their logarithmic sum, and the antilogarithm, measured at the output connection of the device, then represents the product of the two quantities. For division, the currents are fed into the device in such a way that the difference between the two logarithms is obtained. The device is stated to be accurate for multiplication or division within 5 per cent.



The molecular slide rule developed by the Westinghouse Research Laboratories, U.S.A., is here shown with a conventional slide rule for comparison

## Profile Milling with Numerical Control on a 5-axis Machine

AT THE WORKS OF DOUGLAS AIRCRAFT CO., Long Beach, Calif., U.S.A., important savings have been obtained by machining complex structural parts for aircraft on a Giddings & Lewis Variax 5-axis profile miller arranged for Numericord tape control. Among the most intricate components that have so far been produced on the machine are large "pylon" components, one of which is seen set up on the vertical table in Fig. 1. These components are incorporated in the pylons which support missiles under the wings of the launching aircraft. Each is machined from an 870-lb. forged billet of 7079 aluminum alloy, and during the sequence of operations about 780 lb. of metal is removed. The finished part has over-all dimensions of 7 by 28 by 70 in. and weighs approximately 90 lb. Aerofoil contours to meet the requirements of high-speed flight are machined on the outer surface which is visible in Fig. 1. On the inner side there are thin

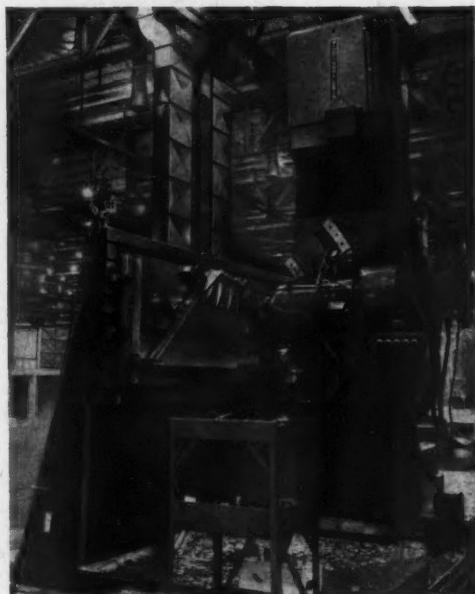


Fig. 1. A close-up view of the Giddings & Lewis Variax machine with a component in position

webs with pockets up to 4 in. deep, as seen in Fig. 2. The surfaces at the bottoms of the pockets are inclined to correspond approximately to the aerofoil surface, and the ribs are tilted.

Originally, conventional types of profiling machines were selected for the production of these components, and 94 fixtures, jigs, and special tools were planned to enable the various operations to be performed. When the decision was taken to utilize the Variax machine, it was found that 86 of the specially planned tools would not be needed and they were cancelled before work on them had begun. As a rule, the saving in the



Fig. 2. The inner side of the "pylon" component is machined with thin webs and pockets up to 4 in. deep. The bottoms of the pockets are inclined and the webs are tilted



Fig. 3. Component for a jet aircraft on which 235 hours of tool design and production time were saved by machining on numerically controlled equipment

cost of tools for a production programme more than pays for the numerical-control programming.

Some other examples of work handled on the Variax machine, with large savings in production time and costs, are here considered. In Fig. 3 is shown a doubler for the DC-8 fuel filler neck which is machined from plate stock. In addition to the visible detail, the part has a tapering web thickness and the rear side is machined approximately to the contour of the wing. The part is completed at two settings on the Variax machine and without any designed holding fixtures, a universal bolster plate being all that is required. Machining by numerical control saved 235 hours of tool design and fabrication time. The preparation time was reduced by 12 weeks and the set-up time by 90 per cent, and productivity was doubled.

The fitting in Fig. 4, for a C-133 aircraft, is rough-machined on both sides and then finished, at two set-ups. Roughing cuts on both sides were held to close limits to provide better control of warping, and special holding arrangements

were employed to ensure the minimum interruption of machining for clamp changing and work loading. The set-up time was reduced from 37.9 hours per part, formerly required, to only 3.1 hours, the machining time from 6.33 to 4.38 hours, and the loading time from 25 to 4 hours.

A front-spar splice-stiffener for the C-133 is also completely machined at two settings on the Variax machine. A fixture surface required for the second setting was machined in position on the Variax to match the surfaces completed at the first stage. The part is produced from bar stock in 80 min.

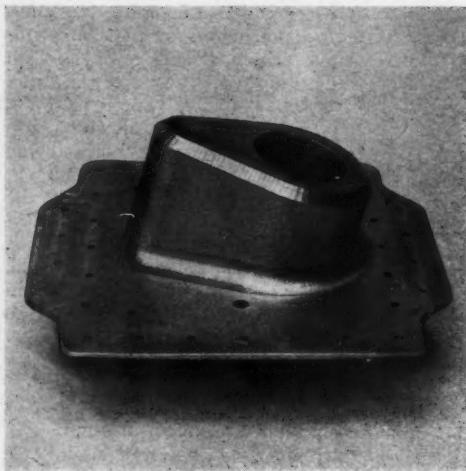
For the DC-8 fuel-probe support fitting which is shown in Fig. 5, four machine motions were required in order to mill the boss at an angle with the base and to produce a pocket, at the same angle, from the reverse side. This part, again, is

completely machined at two settings on the Variax, a single fixture being used for both left- and right-hand forms. The floor-to-floor time is only 70 min., which represents a saving of more than 7 hours per part as compared with the previous method. More than 300 hours for tool design and production were saved, and more than 400 parts have been produced from one magnetic tape.

The DC-8 seal fitting shown in Fig. 6 required rapid and accurate response of both twist and tilt motions of the machine to enable the corner fillets to be negotiated. The availability of these motions

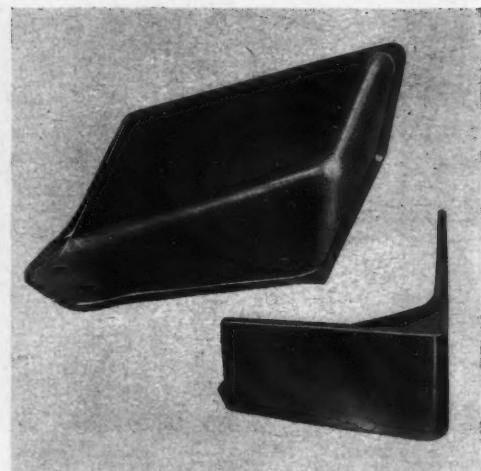


Fig. 4. This aircraft fitting was milled from solid stock on a numerically controlled machine with a 92 per cent saving in set-up time, a 31 per cent saving in machining time, and an 84 per cent saving in loading time



**Fig. 5.** Four motions of the Variax machine were required for milling the boss on this part and a corresponding pocket in the reverse side

eliminated the need for a number of tools that would have been necessary for conventional machining. Nine fixtures would have been required to machine this part by normal methods, whereas with numerical control of the Variax machine, a universal bolster plate was all that was needed.



**Fig. 6.** Both the column swivel and head-tilt motions of the Variax machine were required for milling the outer corner of this fitting

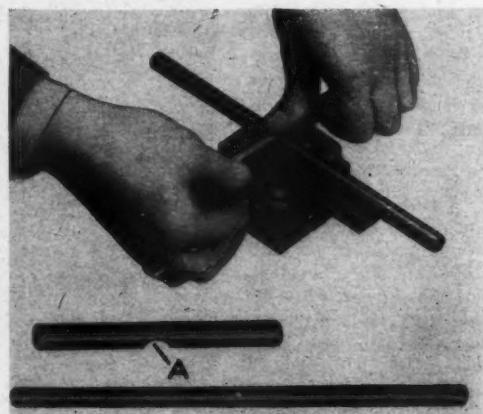
An engine mount back-up fitting for the C-133 aircraft is also machined from a solid forging. The set-up time for this part was reduced from 13.8 hours needed when the part was machined on a conventional profiler to only 1.2 hours. Moreover, the machining time for each component was 1.09 hours, as compared with 2.63 hours.

### Rubert B-block for Testing Squares

The figure shows a method of checking the accuracy of squares with the aid of one of the patented B-blocks made by Rubert & Co., Ltd., Demmings Road, Councillor Lane, Cheadle, Cheshire. As already described in MACHINERY, the Rubert B-block is a supporting stand for round components which incorporates four precision balls retained in a ring member.

These blocks, which are stated to be accurate to  $\pm 0.0002$  in., can be adjusted to compensate for wear. Two different angles of contact are provided by the same block, since the pairs of balls are unequally spaced by means of an accurate separator. These angles are precisely at 90 deg. to each other, and it is this feature which enables squares to be checked, by means of the two test

bars seen in the foreground. It will be noted that the shorter bar is cut away at A, to provide clearance for the long bar.



**Use of a B-block for checking a square**

# NEW PRODUCTION EQUIPMENT

Edited by  
**G. W. Mason**  
 and  
**A. J. Barker**

## Crowthorn 8½-in. Combination Turret Lathe

On the 8½-in. combination turret lathe seen in the figure, which is built by Crowthorn Engineering Co., Ltd., Atlas Works, Reddish, near Stockport, Cheshire, diameters up to 17 and 9¾ in. can be swung over the bed and the cross-slide, respectively, and a maximum distance of approximately 4 ft. can be obtained between the spindle flange and the faces of the hexagon turret.

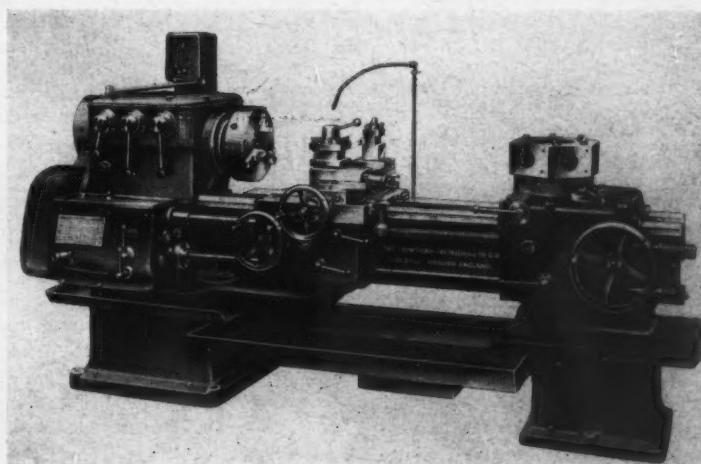
Bored 2½ in. diameter, with a No. 4 Morse taper, the spindle normally has an American A1 8-in. nose, and is equipped with a 12-in. diameter 3-jaw chuck. It runs in pre-loaded Timken precision taper roller bearings, with a plain roller bearing at the rear. Drive from a 6-h.p. motor, mounted on slide rails at the back of the bed, is transmitted through V-belts to the geared headstock, and a total of 12 spindle speeds from 22½ to 583 r.p.m. is obtainable. A multi-plate clutch, of patented design, is incorporated in the headstock pulley, and a brake is provided. Gears and shafts in the headstock are of high carbon or nickel chromium steel, heat treated, and the splined shafts for the sliding gears are ground.

As an alternative, the machine can be supplied with a high-speed headstock, which incorporates shaved gears and Gamet micron precision bearings. If a 2-speed motor is employed, speeds ranging from 15 to 778 or 19½ to 1,004 r.p.m. can be obtained with this headstock.

A quick-change gearbox provides 40 feeds from 12 to 160 cuts per in. and 40 thread pitches from 2 to 28 per in. or from ½ to 7 mm., and an arrangement can be incorporated in the headstock, if required, to enable coarse pitches

to be obtained. Provision is made for the use of change gearing, for cutting threads with other pitches within a wide range, and the direction of the feed and screw-cutting motions is controlled by means of a lever on top of the gearbox.

The main and turret saddles are carried on inverted-vee and flat ways on the box-section semi-steel bed. Normally the ways are hand scraped, but lathes can be supplied at extra cost with the guiding surfaces induction-hardened and ground. In the box-type apron for the main saddle, each of the shafts is supported at both ends. At the front of the cross-slide there is a 4-way toolpost mounted on a compound slide rest which can be swivelled through 360 deg., and a single tool post is bolted to T-slots in an extension at the rear. Separate trip mechanisms, with multiple adjustable dogs, can be provided for automatically disengaging the sliding and surfacing feeds, also the turret feeds. If required, the turret can be arranged for rapid power traverse by means of a push-button-operated motor which is flange-mounted on the apron. The turret faces can be machined to accommodate tooling equipment from one of a number of standard



Crowthorn 8½-in. combination turret lathe

ranges, and the machine can be equipped with an overhead guide bar, if desired.

Coolant equipment is incorporated, normally with a belt-driven pump, and the machine weighs approximately 2½ tons.

### Lidköpings Type 2C Centreless Grinding Machine

Briefly mentioned in a recent issue of *MACHINERY*, the Swedish-built Lidköpings 2B/SP centreless grinder displayed at the recent European Machine Tool Exhibition in Brussels was the prototype for the type 2C machine shown in the accompanying figure. This machine replaces the type 2B formerly built by the company, for whom the British agents are Drummond-Asquith, Ltd., King Edward House, New Street, Birmingham 2, and it is intended for grinding by the plunge and through-feed methods. The capacity is from 0.004 to 2% in., and the recommended working range is up to ¾ in., or ¾ in. for bars. It is claimed that the work is ground within an accuracy of 0.00004 in. (1 micron) for size, and between 0.00002 to 0.00004 in. for roundness, taper and concentricity.

The 12-in. diameter grinding wheel may have face widths up to 4 and 4½ in., for through-feed and plunge grinding, respectively, and the size of the driving motor may range from 3 to 8 h.p. Drive is transmitted through multiple V-belts, three spindle speeds from 1,900 to 2,700 r.p.m. being obtainable by means of interchangeable motor

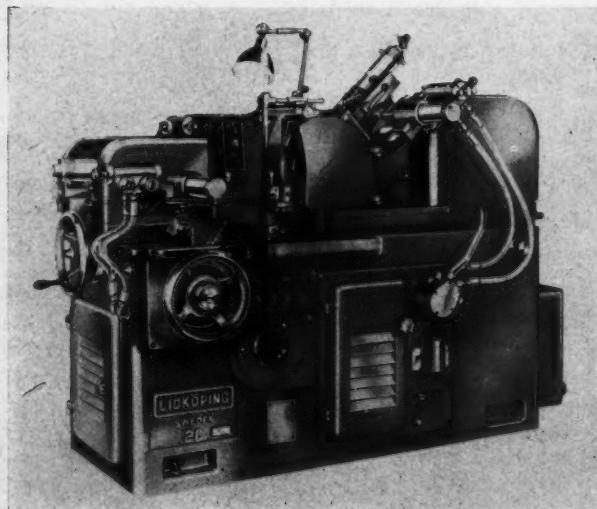
pulleys, and the pulley on the spindle is mounted between the bearings, to reduce the risk of deflection due to belt pull. A d.c. motor for driving the 10-in. diameter control wheel enables steplessly-variable speeds up to 300 r.p.m. to be obtained. Final drive to the spindle is by worm gearing, which runs in an oil bath. Both spindles are carried in double-row roller bearings, which are lubricated by a high-pressure oil mist system. Hydraulically-operated profile dressing units are provided for both wheels, and the diamond holders are carried by slides which are mounted on rollers, to enable multi-step profiles to be copied to an accuracy, it is claimed, of 0.00004 in.

Both the control and grinding wheel-heads can be adjusted towards and away from the work, and coarse movements are applied to the latter, which is mounted on automatically-lubricated roller ways, by means of a handwheel that has a large-diameter scale drum graduated in divisions of 0.0002 in. Fine adjustment is effected by a push-button-operated system and a graduated knob provides for selecting increments ranging from 0.00002 to 0.00024 in. This system is suitable for connection to an automatic sizing attachment. During plunge grinding, in-feed movement is controlled to a high degree of accuracy by a fixed stop, and motion is normally imparted to the head by means of a lever. To provide for automatic working, however, a cam-operated feed mechanism can be supplied at extra cost, which enables operating rates from 100 to 900 cycles per hour to be obtained.

Alternative spindles which can be supplied for the grinding head permit the wheel to be adjusted axially with an accuracy of 0.0004 in., while an operation is in progress, and with this arrangement, shoulders and cylindrical portions of the work can be ground at the same set-up.

Carried on chilled vee and flat ways on the bed casting, the control head is adjusted by means of a handwheel which has a scale drum graduated in divisions of 0.0004 in., and it has been strengthened to increase the rigidity. The upper part of the head can be adjusted parallel to the spindle axis, to facilitate setting for profile grinding, and provision is made for inclining the wheel to either side of the vertical position.

Vertical adjustment of the holder for interchangeable work-support blades is effected through bevel gearing by a crank handle at the front of the machine, and there is a graduated



Lidköpings type 2C centreless grinding machine

scale, to facilitate setting. Drive for the pump in the hydraulic system is taken from a  $\frac{1}{2}$ -h.p. motor, and a coolant system is provided, the fluid being drawn from a separate 45-gal. capacity tank by a  $\frac{1}{2}$ -h.p. motor-driven pump. Electrical control equipment is housed in a separate cabinet.

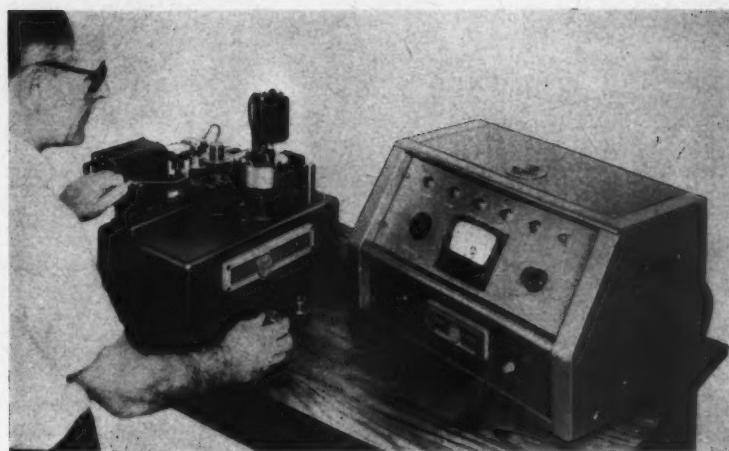
The machine weighs approximately 2½ tons, and a floor space of about 10 by 8 ft. is required. A wide range of additional items is available, including equipment for dynamically balancing the wheels *in situ*, dressing attachments for various purposes, a number of hand-operated and automatic loading units, an automatic ejector, and feed tables for use when grinding bars of various lengths.

### Red Ring Inertia-type Rolling Gear Tester

In the figure is seen the Red Ring inertia-type rolling gear tester, which has been introduced recently by National Broach & Machine Co., Detroit, Mich., U.S.A., and is marketed in Great Britain by their associated company, Precision Gear Machines & Tools, Ltd., Red Ring Works, Bodmin Road, Coventry.

Work and master gears with centre distances ranging from 1% to 12½ in. can be accommodated. During testing, the master gear, which is carried by a pivoted arm, is held in mesh with the workgear by an adjustable spring arrangement and is driven at variable speeds by a universal motor, drive being transmitted to the master gear shaft by a toothed belt. Errors in the workgear cause movements of the arm carrying the master gear, and separate electrical systems are provided for detecting tooth eccentricity, pitch variation, and deviation of the tooth size from the nominal value, to an accuracy of 0.0001 in. A red lamp on the separate control unit is illuminated if any of these characteristics exceed the acceptable limits, and another lamp is illuminated simultaneously to indicate the reason for rejection. In addition, the eccentricity may be read on a large dial on the control unit.

Two pins are mounted at positions 90 deg. apart on the arm carrying the master gear, and serve to



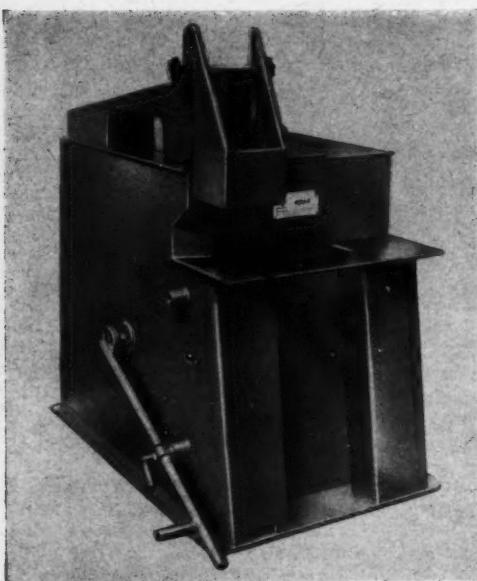
With this Red Ring inertia-type rolling gear tester, separate checks are made for eccentricity, and the accuracy of the pitch and tooth size

actuate the detecting systems. One of these pins is associated solely with the system for determining pitch variation, and the other with the determination of eccentricity and tooth size errors. Since pitch variations are thus detected separately, surface defects considerably smaller than the eccentricity tolerance will cause operation of the rejection indicator, and it is claimed that nicks of only 0.0005 in. high on the tooth flanks can be detected. In the pitch measuring system, the inertia of a weight, which is suspended from leaf-spring arms, is sufficient to prevent the associated electrical system from following small to and fro movements due to pitch variations, and the arrangement is such that only the maximum travel of the master gear is indicated.

For testing, the workgear is loaded on to a vertical shaft, and is engaged with the master gear. The workgear then actuates a switch whereby checking is delayed until the gear has been turned through one revolution. Checking is carried out during the next revolution. After the operation has been completed, the gear is raised by means of a lever, and thus disengaged from the master, to facilitate removal. The cast iron base of the testing unit occupies an area of 22 by 15 in., and the control unit measures 22 by 14½ in.

### Neva-Scimitar Cutting-off Machine

Anderston Clyde Engineers, Ltd., Irk Vale Works, Chadderton, Manchester, have recently introduced the Neva-Scimitar friction cutting-off



Neva-Scimitar cutting-off machine

machine shown in the accompanying illustration. Drive is provided by a motor of 8 h.p., running at 3,000 r.p.m., the 21 in. diameter, alloy-steel friction-cutting blade being mounted directly on the armature shaft. Bar or tube up to 4 in. diameter can be cut, also sections up to 6 by 4 in. and strip up to 20 by  $\frac{1}{2}$  in. Mitre, groove, and notch cutting can be carried out, and as an example of the capabilities of the machine, it is stated that 2- by  $\frac{1}{2}$ -in. angle section can be cut in 2 sec., also that it is possible to cut a standard type of bar cam with clean, square edges, and without any buckling.

The machine has a fabricated steel frame and weighs approximately 7 cwt. If desired, a star-delta starting switch, with motor protection features, can be

provided. A re-sharpening service for the cutting blades is available.

### Noble & Lund Fluifeed 38-in. Horizontal Sawing Machine

Noble & Lund, Ltd., Felling-on-Tyne, Gateshead, 10, have recently built the 38-in. horizontal-table Fluifeed circular cold sawing machine shown in Fig. 1 for sawing aluminium slabs measuring up to 42 by 10 in. by 10 ft. long. The saw carriage is of box construction and as may be seen in the rear view, Fig. 2, it moves on an under bed which has a long narrow guide for the carriage.

The high-tensile steel saw spindle is mounted in taper roller bearings, and it is driven by a 40-h.p. motor, through V-belts and spur and double-helical gears, all the gear shafts being mounted in ball bearings. Cutting speeds of 2,000 and 3,000 ft. per min., on a 38-in. diameter blade, are given by change gears in the saddle. A travel of 5 ft. is provided for the saw carriage, and steplessly-variable feed rates up to 100 in. per min. are available by means of the patented Fluifeed system, which incorporates a hydraulic pump driven by a 5-h.p. motor. Upon completion of the cut, the saddle is returned automatically under rapid traverse. Relief valves in the hydraulic circuit prevent damage in the event of jamming, and the length of the saw saddle traverse is determined by adjustable stops.

The table, of large area, is made in two pieces with a space between them for the passage of the saw. Both table sections are supported at each



Fig. 1. Front view of the Fluifeed 38-in. horizontal cold sawing machine for aluminium slabs



Fig. 2. View from the rear of the 38-in. Fluideed hydraulic cold sawing machine

end and are independent of the saw carriage bed, the arrangement being such that swarf is prevented from falling on to the bed-ways. Cuttings pass directly through the bed on to a drag-link, slat-type-conveyor, whereon they are carried to a height of approximately 5 ft. above floor level and discharged into a bin. Drive to the conveyor is taken from a 5-h.p. motor. Arrangements are made to separate swarf from the coolant, and the latter is re-circulated by means of an electrically-driven pump.

Double vices, powered by a 5-h.p. motor, are fitted so that both sides of the work are gripped during the cutting operation. With this arrangement, both ends of a billet can be cut without turning it end for end. Ingoing and outgoing power-driven roller tables are also provided. A 2-h.p. motor is used for the ingoing table and a 1-h.p. motor for that on the outgoing side. A side guide roller is fitted to the ingoing table to position the slab to be cut in relation to the vice jaws. When the machine is used for sawing billets of 99.1 per cent pure aluminium, it can cut through a cross section of 420 sq. in. in 1 min. The weight of the machine, inclusive of electrical equipment, is 17½ tons.

### Dumore High-speed Unit Drilling Heads

Marketed in this country by Automation, Ltd., Devonshire House, Vicarage Crescent, London, S.W.11, the American-made Dumore Series 34 unit head seen in the illustration has capacity for drilling holes up to  $\frac{1}{2}$  in. diameter, depending on the work material, and incorporates a system

whereby it can be interlocked electrically with other equipment, for operation in sequence in an automatic set-up. Units of similar design and size are also available, and are designated Series 36, but these units do not incorporate the interlocking arrangements.

On each unit, a cylindrical portion at the front of the spindle housing provides for clamping the unit in various positions, and facilitates removal and incorporation in a fresh set-up. A Jacobs No. 7

chuck, of  $\frac{1}{4}$ -in. capacity, is mounted on the nose of the spindle, which runs in matched, pre-loaded duplex bearings, and is driven from a  $\frac{1}{2}$ -h.p. motor through a nylon-reinforced toothed belt. The belt pulleys normally fitted provide a spindle speed of 12,500 r.p.m. when the unit is connected to a 50-cycle a.c. electrical supply. Interchangeable pulley sets are available to give speeds down to 666 r.p.m., and all the rotating parts are dynamically balanced, to reduce the risk of vibration.



Dumore Series 34 high-speed unit drilling head

Working travel of the spindle, up to a maximum of 3 in., can be pre-set within  $\pm 0.001$  in., and it is claimed that the length of successive drilling strokes is maintained to an accuracy of  $\pm 0.001$  in. Axial motion is applied by an air-operated system, and the automatic cycle comprises rapid approach, feed and rapid return. The approach and feed rates can be varied up to 600 and 60 in. per min., respectively. Adjustment is also provided for the feed thrust, which has a maximum value of 450 lb. when compressed air at a pressure of 100 lb. per sq. in. is used. If required, a cycle timing arrangement can be supplied so that the spindle is advanced automatically in a series of steps to facilitate swarf removal when drilling deep holes. A hydraulic check arrangement is also available, for controlling the feed rate when the drill breaks through at the rear of the workpiece, for example.

Weighing 88 lb., the unit has a maximum overall length of  $27\frac{1}{2}$  in. with the spindle extended, and measures approximately 8 $\frac{1}{2}$  in. wide by 15 in. high. In addition to the accessories mentioned, the extra equipment which is available includes mounting brackets, and a range of bases, tables and columns for use with the unit.

### Pratt & Whitney Optical Tool-setting Unit

Introduced recently by the Pratt & Whitney Co., Inc., West Hartford, Conn., U.S.A., the optical unit here shown is intended primarily to facilitate the pre-setting of cutting tools which

are adjustably-mounted in interchangeable holders. It also enables run-out and the condition of the cutting edge to be checked.

Tool holders with straight and tapered shanks are secured by means of adapters to the nose of the headstock spindle, which is mounted in precision ball bearings, and the cutter point is observed through a high-magnification microscope, carried on a compound slide. Mounted on ground and lapped ball ways, this slide can be set for diameters and lengths up to 6 and 12 in., respectively, and is positioned initially, to the nearest inch, by means of length bars which are placed in ground and lapped V-blocks. Final setting is obtained by means of accurate micrometer heads, which are arranged to give readings to 0.0001 in.

Machines and equipment built by the Pratt & Whitney Co., Inc., other than Keller die-sinking machines, are marketed in this country by Buck & Hickman, Ltd., Otterspool Way, Watford By-Pass, Watford, Herts.

### Induction Hardening Machine for Engine Rocker Screws

In the accompanying illustration is shown an automatic machine for induction hardening, on a mass production basis, the tips of rocker screws for motor car engines, which has recently been built by Induction Heating Equipment Ltd., 11 Molesey Road, Hersham, Surrey.

The screws to be hardened are loaded into a vibratory feed hopper seen on the left, whence they are fed up an internal ramp and then through a gate mechanism which ensures that each screw is correctly orientated. From the gate, the screws move down a tube and are delivered, one at a time, by a shutter mechanism controlled by an electromagnetic stop arrangement, into nests on a stainless-steel endless belt. The latter carries them through a "skate" type high-frequency induction coil fed from a 400 Kc generator by way of a suitable transformer. After being



Pratt & Whitney optical tool-setting unit



**Induction hardening machine for engine rocker screws built by Induction Heating Equipment, Ltd.**

heated to hardening temperature, the screws pass through a quenching tunnel and finally fall from the belt into a wire basket.

An output of 1,500 pieces per hour is obtained, and the equipment can be readily modified to handle screws of other sizes.

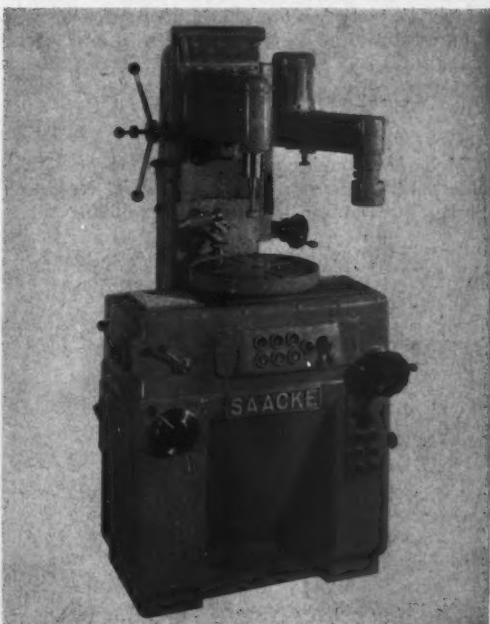
### Saacke VJ2 Vertical-spindle Internal Grinding Machine

Times Machinery Co., Ltd., Poyle Road, Colnbrook, Slough, Bucks., are now marketing the German-built Saacke VJ2 vertical-spindle internal grinding machine shown in the accompanying illustration. This machine has capacity for grinding bores from  $\frac{1}{4}$  to 6 in. diameter, of 7 in. maximum length, and the throat depth is  $11\frac{1}{2}$  in.

Drive for the grinding head is taken from a motor of about  $\frac{1}{2}$  h.p., and is transmitted by a flat belt to the wheel spindle, which is driven at 9,000 or 18,000 r.p.m. The spindle is carried in a  $2\frac{1}{2}$ -in. diameter housing, which is clamped in the head. For grinding bores longer than 7 in., the entire unit can readily be removed and replaced by a similar unit, which is available as extra equipment. Mounted on ways at the front of the column, the head can be adjusted vertically by means of a capstan wheel, and for grinding, it is reciprocated hydraulically at steplessly variable rates. The direction of motion at each end of the grinding

traverse is reversed by adjustable trip dogs at the left-hand side of the head, these dogs actuating a hydraulic valve.

Speeds of 110 and 220 r.p.m. are provided for the  $12\frac{1}{2}$ -in. diameter work-table, which is driven by a separate  $\frac{1}{2}$ -h.p. motor. The table has a central No. 4 Morse taper socket, to accommodate a spigot for locating the work, and it can be tilted through a maximum angle of 10 deg., for grinding taper bores. Increments of radial feed are applied by moving the table assembly along longitudinal ways on the bed, and motion is normally applied manually, by means of a handwheel which is graduated in divisions of 0.00025 in. If required, however, equipment can be incorporated whereby feed is applied automatically for roughing to within 0.0008 in. of a predetermined size. When an operation has been completed, or if it is desired to check the bore being ground, a 3-position lever at the front of the machine is moved from the working setting to the other two positions successively. As a result, the grinding head is first raised to the top of the column to withdraw the wheel from the work, the table assembly is next traversed hydraulically to the right-hand end of the bed-ways, and the table drive



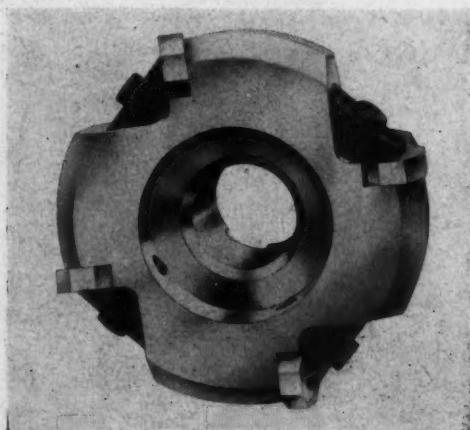
**Saacke VJ2 vertical-spindle internal grinding machine, which incorporates a swivel-mounted face grinding attachment**

is then disengaged. The sequence of motions is reversed when the lever is returned to the working setting, for resumption of the grinding sequence, and the table assembly is returned to the position at which the operation was interrupted. Hydraulic interlocks are provided, to prevent movement of the lever to the final position in each direction until the previously-initiated motion has been completed. Pressure oil for the hydraulic system is delivered by a  $\frac{1}{2}$ -h.p. motor-driven pump.

A hand-operated diamond dressing unit is provided, and the machine is usually equipped with a swivel-mounted attachment, for grinding the upper face of the work. For this operation, the table is set at the right-hand end of the bed-ways. Grinding wheels up to 5 in. diameter can be mounted on the vertical spindle of this attachment, and drive is taken through two V-belts from an individual  $\frac{1}{2}$ -h.p. motor. The entire unit is carried on ways at the right-hand side of the column, and is adjusted vertically by means of a handwheel which has a drum graduated in divisions of 0.0005 in. Additional equipment for the machine includes a dust extractor, and magnetic and 3-jaw chucks for mounting on the work-table, also a coolant system. The machine weighs approximately 1 $\frac{1}{4}$  tons, and occupies a floor space of 2 ft. 8 in. by 2 ft. 6 in.

### Octaken Throw-away Tip Milling Cutter

Made by Saunderson & Costin (Cemented Carbides), Ltd., Andover Road, Highclere, Newbury, Berks., the Octaken throw-away tip milling cutter



Octaken milling cutter with throw-away tips

is available in two sizes, with diameters of 4 and 6 in., which incorporate 4 and 6 inserted tungsten carbide tips, respectively.

These tips are octagonal in shape, and are clamped in locating recesses in the body, as seen in the accompanying illustration. With this arrangement, each tip can readily be turned, to present a fresh cutting edge when the portion in use has become dulled. Moreover, as the recesses are disposed angularly to provide for cutter clearance, each tip can be reversed when all the edges on one side have become dulled, and in this way, a total of 16 cutting edges can be brought into use before a tip is discarded.

**PLUS-GAS CORROSION PREVENTION FLUIDS AND RUST REMOVER.**—Products of the Plus-Gas Co., Ltd., Trevor House, 100 Brompton Road, London, S.W.3, include various corrosion-prevention fluids and cutting fluid. Formula A dismantling fluid, which is non-acid, is intended for freeing seized parts, and it is reported that at one colliery, £6,000 was saved in a year by its use on rusty scraper chains. It is claimed, moreover, that this fluid is capable of loosening blades and casing studs in large turbines without damaging them.

Plus-Gas Formula B is suitable for coating stored machinery or components in transit, particularly in tropical climates. It forms a tough but elastic film which is said to be immune from cracking when the coated metal expands with rising temperature. Formula B compound is soluble in oil, and need not be removed from oil-immersed moving parts, except plain bearings. It is unaffected by temperatures up to 100 deg. F., and has good penetration properties.

Another product, known as Plus-Gas Formula E, combines with the oxides on corroded metals to form insoluble tannate films, and thus prevent further corrosion. The liquid, it is stated, produces smooth and burnished surfaces suitable for painting, and as it is non-acid and non-toxic, it can be easily and safely applied.

Reference may also be made to Formula C cutting oil, which has low surface tension and is said to penetrate the intergranular crevices of metals and to provide effective films between tools and workpieces. It is claimed that a clean cutting action is thus ensured, and that build-up on the edges of cutting tools is considerably reduced.

**DIESEL AND DIESEL-ELECTRIC** train locomotives added to the operating stock of the British Transport Commission during the first half of this year totalled 197, as compared with a total of 202 for the same period in the preceding year.

## Fritz Werner Type FV 2D Tape-controlled Vertical Milling Machine

The type FV 2D vertical milling machine built by Fritz Werner A.G., Berlin-Marienfelde, Germany, has recently been adapted for automatic operation under the control of Brown-Boveri punched tape equipment as shown in the accompanying figure. This machine was displayed at the 7th European Machine Tool Exhibition held recently in Brussels, and will be available for demonstration from November 7 to 22 at the showrooms of Rockwell Machine Tool Co., Ltd., Welsh Harp, Edgware Road, London, N.W.2, who represent the makers in this country.

The tape system provides for controlling movements of the table longitudinally and transversely, and movement of the machine knee vertically, all under rapid traverse and feed, also for starting, stopping and reversing the spindle. Different feed rates can be brought into use during the working cycle, and co-ordinate settings can be obtained under tape control. Information for controlling the various functions is punched into 5-channel tape, which is fed into a reader built into a separate floor-mounted console. The tape is scanned by photo-electric cells, and signals relating to the required position of the table in the longitudinal direction, for example, are fed into a memory unit.

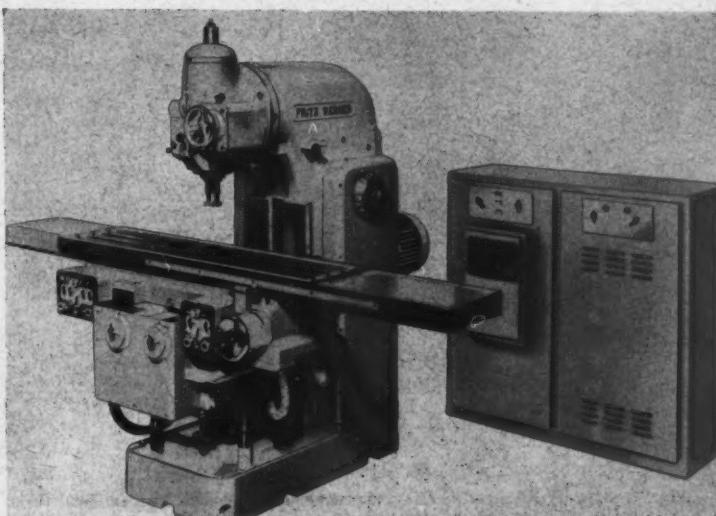
At the next stage, the cutter spindle and the power drive for the longitudinal traverse are started, and feed-back signals which correspond to the actual positions of the table at various points in its travel, in steps of 0.0004 in., are transmitted by an analogue system from synchros, to which backlash-free drive is provided by a rack and pinion and gearing. As soon as the feed-back signal corresponds to that fed into the memory unit, a relay is operated

to stop the table, and apply a brake. The tape is then advanced and the next movement initiated.

An allowance can be made in the programme to compensate for over-run at the end of the traversing movement, to enable the table to be stopped accurately in the desired position. Alternatively, provision can be made for automatic reduction of the traversing speed during the final part of the table movement, to permit accurate positioning. Other synchros driven by racks and pinions are fitted to provide feed-back signals for the cross-slide and knee movements.

The 53- by 14-in. table on the type FV 2D machine has longitudinal and transverse traverses of 39 $\frac{1}{2}$  and 11 in., and the vertical movement of the knee is 17 in. Sixteen feeds are provided which may range from  $\frac{1}{16}$  to 10,  $\frac{1}{8}$  to 20, or  $1\frac{1}{2}$  to 40 in. per min., longitudinally and transversely, and from  $\frac{1}{16}$  to 2,  $\frac{1}{8}$  to 4 or  $\frac{1}{4}$  to 8 in. per min. in the vertical direction. There is a choice of 18 spindle speeds, from 35% to 1,800 r.p.m.

The tape control system can be applied to all Fritz Werner electrically-controlled knee type milling machines of type 2D and larger sizes.



Fritz Werner type FV 2D tape-controlled vertical milling machine

## E.I.A. Fourteenth Engineering Exhibition

AS ON PREVIOUS OCCASIONS, a wide range of products was displayed by member companies of the Engineering Industries Association, at the London Region Engineering Exhibition—the fourteenth in the series—which was held recently at the Royal Horticultural Society's New Hall, Vincent Square, London, S.W.1. Attention is here drawn to some exhibits likely to be of particular interest to readers of MACHINERY.

Equipment displayed by A. Capp & Son, Ltd., Thames Road, Crayford, Kent, included the new Verdict O'B electronic gauge, the measuring head for which, shown mounted on a height stand at A in Fig. 1, is only  $\frac{1}{8}$  in. diameter by 3 in. long, and weighs 1 oz. It is connected electrically to the fully-transistorized indicator unit shown at B, which can be set by means of a switch to give full-scale readings of  $\pm 0.001$  and  $\pm 0.0002$  in. At the higher magnification, each division on the 3·4-in. wide scale represents a movement of the stylus pin on the measuring head of 0.00002 in., but smaller movements can be readily estimated. The instrument is designed for operation on an a.c. supply, without the need for rectifiers and transformers, and incorporates nickel cadmium secondary cells for stabiliz-

ing the control circuit, these cells being charged from the mains. When the cells are fully charged they permit the instrument to be operated independently of the mains supply for a maximum period of 10 hours without drift in magnification or zero setting. An "on/off" switch, knobs for adjusting the magnification, and zero setting, also sockets for connecting other meters and servo equipment to the instrument, are provided on the end faces of the body.

Friction-free movement from the stylus pin is transmitted to a non-ferrous inductive transducer built into the measuring head by a miniature cross-spring pivot. The stylus pin can be set at angles of 15 and 75 deg. to the centre line of the measuring head, and since the contact force between the ball end and the work is only 0·4 oz., the instrument may be used to advantage for checking wafers for transistors, also rubber, paper and plastics products, as well as metal parts. Stylus pins which have an overall length of  $1\frac{1}{16}$  in., and ball ends of 0·080 and 0·030 in. diameter are normally provided, but other lengths can be supplied if required. The measuring head may be mounted horizontally, vertically, or at an angle, and the clamp which surrounds the body will take a  $\frac{1}{4}$ -in. diameter bar for fixing purposes. In addition to inspection duties, the instrument may be set up on machines of various types, and the operation of the measuring head is unaffected by magnetic fields. As a consequence, the instrument may be employed for checking a work-piece held by a magnetic chuck, for example, on a surface grinder.

A 0·001-in. thick plastics gauge, known as a Felaslip, which is the subject of a patent application, is employed for calibrating the instrument according to the angle at which the stylus pin is inclined to the surface to be checked on the work. The gauge

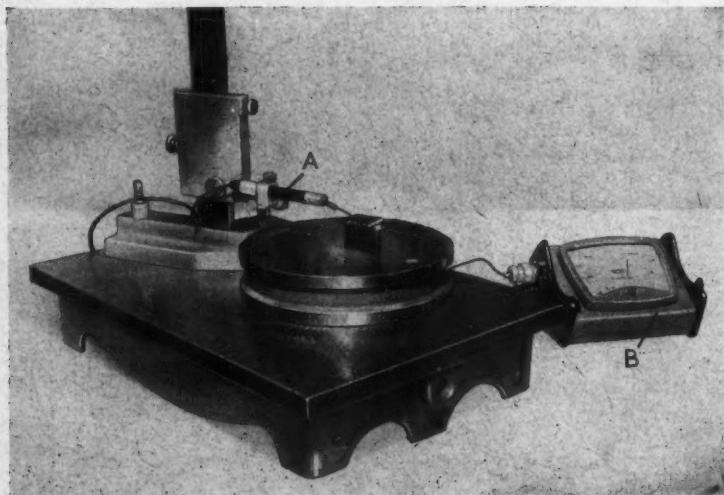


Fig. 1. The Verdict O'B electronic gauging equipment can be set to give full-scale readings of  $\pm 0.001$  and  $\pm 0.0002$  in. Signals are transmitted to the indicating unit by a transducer built into the gauging head

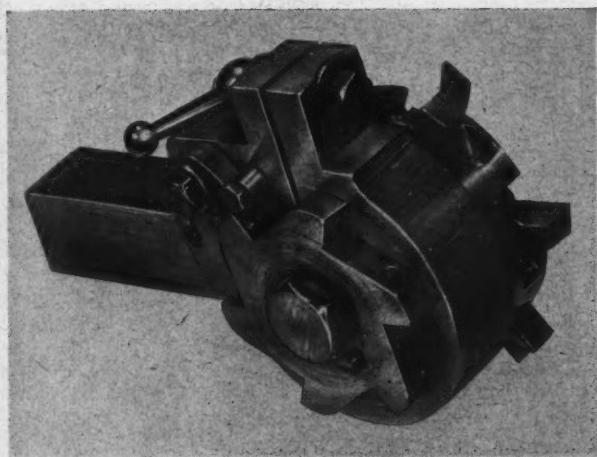


Fig. 2. Ormiston 6-station indexing tool-holder for a lathe

is held to an accuracy of  $\pm 0.00001$  in. for thickness, and is stated to be unaffected by moisture and variations in ambient temperature. For calibrating, a zero reading is obtained on the indicator unit after the stylus pin has been brought into contact with the work surface. The Felaslip gauge is then interposed between the work surface and the stylus pin, and, if necessary, the knob for adjusting the magnification is turned until a reading of  $+0.0001$  in. is obtained on the indicator unit.

#### AN INDEXING TOOL-HOLDER

In Fig. 2 is shown a 6-station indexing tool-holder for a lathe, which has recently been placed on the market by P. Ormiston (Engineers), Ltd., Broughton Road, London, W.13. Individual tool-bits are held in slots milled in the end face of a disc at one side of the body, by clamping screws. The assembly is indexed by hand, and is located for angle, at the individual working positions, by a ratchet and spring-loaded pawl assembly at the other side of the body. At each position, the end of the pawl remote from the pivot makes contact with a grub-screw in a tapped hole in the ratchet, which can be adjusted for pre-setting the cutting edge of the tool-bit for height. At one end of the body there is a  $2\frac{1}{4}$ -in. long shank of  $1\frac{1}{8}$  by 1-in. cross section, and the other takes the form of a split-type clamp, which is tightened by a ball-ended lever and screw, to prevent rotation of the disc and ratchet when indexing has been completed.

#### A HYDRAULIC VICE

Euco Tools, Ltd., Armfield Close, Industrial Estate, West Molesley, Surrey, have recently developed a hydraulic system which can be incorporated in a conventional machine vice, and enables a considerable gripping force to be applied to the work without high torque on the traversing screw for the moving jaw. The Abwood 6-in. capacity vice shown in Fig. 3 incorporates the Euco system, and is fitted with a load cell for measuring gripping force. In this instance, the gripping force applied to the load cell exceeds 2 tons.

When a workpiece has been loaded into the vice, the moving jaw is advanced by the traversing screw in the usual way, and force is applied to the crank by hand to provide a light grip. A screw which extends from the side of the moving jaw and is fitted with a ball-ended ratchet-type handle, is then turned, with the result that pressure is applied



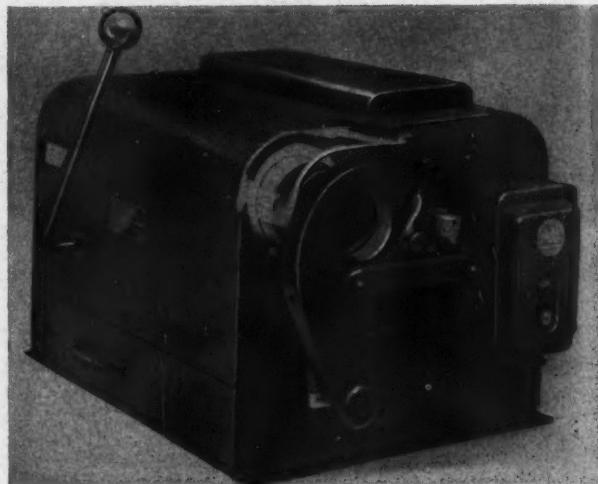
Fig. 3. This Abwood machine vice incorporates a hydraulic system developed by Euco Tools, Ltd., which enables a high gripping force to be readily applied to the work

to the jaw piece hydraulically to give a high gripping force. Rotation of the screw causes a pressure pad to be advanced, so that hydraulic fluid from a small-diameter bore machined in the moving jaw is passed to two other bores at right-angles to the first, which extend to the end face. These bores are fitted with seals, also pressure pads which make contact with the rear face of the jaw-piece for applying the gripping force. The ratio of the total area of the bores in the end face to that of the small-diameter bore is 16 to 1.

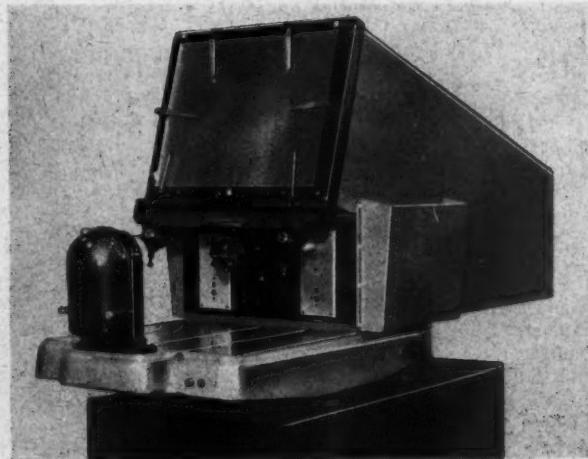
In addition, the company displayed examples from a new range of rotating centres which can be supplied with Morse taper shanks in sizes from No. 1 to No. 4, also straight shanks from  $\frac{1}{8}$  to  $1\frac{1}{2}$  in. diameter, and lengths from 2 to  $3\frac{1}{2}$  in. The smaller sizes in the range are fitted with deep-groove ball bearings, and the larger centres have deep-groove ball bearings at the nose and taper roller thrust bearings at the rear ends. They can be supplied with cone centres which have nose angles of 60, 70, 75 and 90 deg.

#### BENCH-MOUNTED OPTICAL PROJECTOR

The new type B.C. 1512 bench-mounted optical projector, shown in Fig. 4, which has recently



**Fig. 5. Leonard Tubemaster type 2CP flaring and beading machine for ferrous and non-ferrous tubes from  $\frac{1}{2}$  to 2 in. diameter. Machines are available for tubes up to 8 in. diameter**



**Fig. 4. Shadomaster type B.C. 1512 bench-mounted optical projector**

been added to the Shadomaster range made by Watson, Manasty & Co., Ltd., Orleans House, Manor Road, Teddington, Middlesex, is particularly intended for inspecting parts on a repetition basis, and has a  $17\frac{1}{2}$  by  $16\frac{1}{2}$ -in. T-slotted base to take work-holding fixtures. The distance between the mounting surface of the base member and the centre line of the optical system, and between the condenser lens on the lamp unit and the object plane, is 6 in. A focusing attachment can be supplied, also a fixture with a vertical adjustment of  $2\frac{1}{2}$  in., or, alternatively, a work stage which has micrometer adjustments of 3 in. transversely and  $2\frac{1}{2}$  in. vertically. V-blocks fitted with centres for accommodating work up to 2 in. diameter by  $4\frac{1}{2}$  in. long are available for use with the fixture and work stage.

Lens units can be provided to give different magnifications from 10 to 100 $\times$ , and the satin-etched screen measures 15 by 12 in. An attachment for supporting Shadomaster Optacology charts is mounted below the screen, and can be adjusted in the vertical direction for a maximum of 2 in. There is provision for fine adjustment for distances up to  $\frac{1}{2}$  in. above and below, and to each side of

the central position, to facilitate accurate setting of a chart. Lamp units for illuminating the work for surface projection can be connected to sockets at either side of the lens unit, and operated by push-button switches.

#### TUBE FLARING AND BEADING MACHINE

Made by the Leonard Precision Products Co., Santa Ana, California, U.S.A., the Tubemaster type 2CP machine shown in Fig. 5 was exhibited by Pressbend, Ltd., 28 Marshalsea Road, London, S.E.1, who are the selling agents in this country. Interchangeable tools can be mounted in the spindle for flaring and beading, also for facing the ends square with the bore, and de-burring operations on tubes in ferrous and non-ferrous metals from  $\frac{1}{8}$  to 2 in. diameter. Two spindle speeds are provided, and the drive is started, and an air cylinder for clamping the work is simultaneously energized by movement of a single lever. Tubemaster machines are available in other sizes which will handle tubes up to 8 in. diameter, and the range also includes machines designed for semi-automatic and fully-automatic operation.

#### SIGNAL LIGHT COMPARATOR

The French-made Lip signal light comparator (Microtron, Ltd., 338 City Road, London, E.C.1) can be employed for checking components which are made to limits as small as  $\pm 0.00003$  in., and

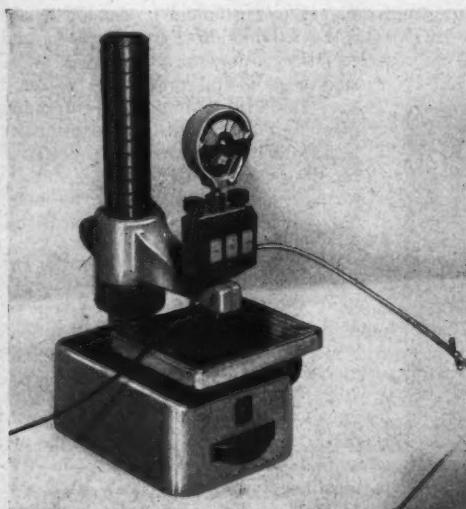


Fig. 6. The French-made Lip signal light comparator

it is stated that the comparator enables dimensional differences of about 0.00001 in. to be detected. The instrument, which is seen in Fig. 6, has a measuring range of 0.040 in., and can be set with the aid of two knobs so that signal lamps of different colours, indicating under-size, acceptable, and over-size workpieces are lit at pre-determined points in the travel of the plunger. If required, the instrument may be fitted with a dial indicator, as shown. The plunger is held in contact with the work under a force of only 4 oz, and can be fitted with interchangeable anvils which have ball, flat, and cylindrical ends. A hand or foot-operated cable release can be provided for raising the plunger when workpieces are to be placed in or removed from the gauging position. A resistance is incorporated in the 2-pin connecting piece, to enable the instrument to be operated direct from a mains supply.

#### Books Received

**THEORY OF METAL CUTTING.** By Paul H. Black. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. 204 pp. [Price 58s. net.]

Various theories of metal cutting are here collected and interpreted. The author deals progressively with the structure and strength of metals, mechanics of cutting, friction, lubrication and wear, types of cutting fluid and cutting tools, and tool life. Grinding, 3-dimensional cutting, and the economics of machining are also discussed.

**DIAMONDS IN INDUSTRY—AN INTRODUCTION.** The Industrial Diamond Information Bureau, 2 Charterhouse Street, London, E.C.1. 12 pp.

This booklet has been issued to meet the needs of students and engineers who require basic information about the varied uses of industrial diamonds. Sections are concerned with the hardness of diamonds, gem polishing, grinding wheels, glass working, dressing and truing, honing and lapping, diamond saws, diamonds for drilling, diamonds for lathe tools and wire drawing dies, non-cutting uses of diamond, and new applications.

**ALLOY STEELS.** Samuel Fox & Co., Ltd., Stocksbridge Works, Sheffield. [Price 42s.]

This attractively-bound loose-leaf book comprises a very comprehensive collection of technical data on a selection of constructional alloy steel, the information being presented in various ways for the convenience of the metallurgist. In addition to data showing the effects of alloy composition, mesh, and heat treatment on the mechanical properties of steel, information is included on the concepts of hardenability, and isothermal and continuous cooling transformations.

The first section is devoted to products and finishes, and the second, to the Fox range of steels grouped according to type. There follow data sheets relating to 21 steels, listed under the En numbers. Finally, there are sections concerned with standard specifications and information tables.

## NEWS OF THE INDUSTRY

### Warwickshire

STUART DAVIS, LTD., P.O. Box 21, Stonebridge Highway, Coventry, are experiencing a very good demand for their fine boring machines, several versions of which have recently been ordered by firms in India, France, and Sweden. The company's Heligrind spur gear grinding machines and Red Ring air cylinders and valves are also in good request. Increasing interest is reported in Schumag combined drawing, cutting, straightening, and polishing machines for producing straight polished rods from steel and non-ferrous coiled stock. The work material is fed continuously through the machine by reciprocating drawing



To facilitate machining operations on the larger components and structures, for which there is an increasing demand, Permal, Ltd., Gloucester, are employing a Wadkin universal pattern milling machine of the latest type. This machine is here shown set up for drilling operations on a transformer end winding ring. It may be noted that the ring comprises more than 200 fully impregnated veneer segments assembled and pressed together in staggered layers with the grain of the beech wood parallel to the tangent

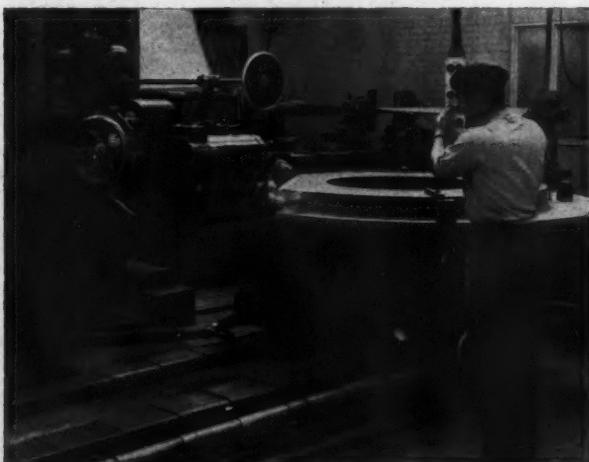
carriages, and cut to length by a flying shear. Severed rods are straightened at the next station and then fed between rotating polishing discs whence they emerge in a finished condition. Among other products handled, mention may be made of wire straightening and cutting-off machinery by Malmedie & Co., Düsseldorf, also fully-automatic transfer presses for the production of screws, nuts, pins and similar parts from round stock, by cold forming methods.

LESTER-BROWN MACHINE TOOLS, LTD., Bayton Road, Exhall, Coventry, are well occupied with the production of single-ended and double-ended lapping machines and special-purpose machine tools. Recently the company completed the first Lester-Brown jig boring machine which is of double-column construction, and has a work-table measuring 35 in. x 20 in. Settings of the spindle-head and work-table are facilitated by optical measuring devices.

MODERN MACHINE TOOLS, LTD., Gosford Street, Coventry, are maintaining a high output of suds pumps for delivery to customers in the home and overseas markets. Production of Modern  $\frac{1}{2}$ -in. and  $1\frac{1}{4}$ -in. capacity bar automatics continues at a

steady rate, and orders are in hand for thread milling and tapping machines. In addition, the company builds oil grooving machines, designed for the production of internal and external curved and straight grooves, also keyways, splines, and serrations.

HOBBS TRANSMISSIONS, LTD., 78 Russell Terrace, Leamington Spa, have extended their production shops at Leamington during the past year and have installed a number of new machine tools including a Newall type 2443 jig borer mainly for operations on special casing parts for Hobbs automatic transmission units, which are available in standard form in two versions, designated types 1015 and 1523, for use with motor cars and light commercial vehicles fitted with engines of 1,000-2,500 c.c. capacity.



Known as the Mecha-Matic automatic transmission, the equipment is similar in size to a normal synchromesh gearbox, and gives self-operating changing, relative to vehicle speed and throttle opening, through four gears. Production of these units at a factory near Manchester is to be increased progressively until the whole of the 200,000 sq. ft. of floor space available is fully utilized.

**PLASTIC ENGINEERING (LEAMINGTON SPA), LTD.**, Trading Estate, Leamington Spa, are still busy with the production of a wide variety of plastics parts for industrial use. A large proportion of the moulded parts supplied by this firm are of nylon and this material is frequently specified for servo mechanism components, bushes, seals, spacers, and bearings. Orders have recently been received for a range of grommets in PVC, and for large quantities of small caps, transit covers, and capacitor terminal shrouds in polyethylene. A noticeable trend is reported towards the use of polypropylene for many purposes, on account of its light weight and favourable physical characteristics. With the facilities at present available, shot weights may range up to  $2\frac{1}{4}$  oz. and it is pointed out that this weight is often ample for a 32-impression mould for very small parts.

**CLARKSON (ENGINEERS), LTD.**, King Edward Road, Nuneaton, are extremely busy as a result of the steady rise in the demand for their milling cutters. Extra shift working is necessary in order to fulfil the orders that are being received from the home and overseas markets. An increasing call is also reported for Clarkson Taperfast drills, which are available in many sizes up to  $1\frac{1}{4}$  in. diameter, and in numerous factories these drills are being employed on an extending scale, particularly for multi-head set-ups. The Taperfast mounting is designed to resist high torsional loading and on test has withstood the force resulting from stalling a  $1\frac{1}{4}$ -in. diameter drill when operating with a coarse feed.

The Autolock range of end mill chucks, which have found extensive application during the past 20 years, has recently been extended to include a new version, designated type "S", which is stated to have improved holding properties and to be stronger in many respects than the earlier Autolock designs. Miniature Dedlock cutters, it may be pointed out, are available in sizes from 1 to 2 in. diameter, for light milling operations.

F. W. HERRIDGE.

**INDUSTRIAL BUILDINGS AND EXTENSIONS** (mainly over 5,000 sq. ft.) approved in the first half of this year numbered 1,096, representing a total area of 26,868,000 sq. ft.

### Trends in Machine Tool Design

Professor J. Loxham, C.G.I.A., M.I.Mech.E., M.I.Prod.E., M.B.I.M., of the College of Aeronautics, Cranfield, Beds., when presenting a lecture entitled "Some Future Trends in Machine Tool Design" to the Coventry Graduate Section of the Institution of Production Engineers expressed the view that many of the machine tools at present employed for operations on close-tolerance parts were quite unsuitable for such work. Pursuing this point, he said that operators were frequently expected to produce components of high accuracy although the machines provided, in many instances, were unsatisfactory, for example, because the slides did not follow straight paths within acceptable limits for precision engineering.

Research directed towards the improvement of machine tool design had shown that pre-loaded roller slides might, in certain circumstances, be employed with advantage for the wheel-heads of grinding machines, and it had already been established, experimentally, that slides of this type could be moved, if required, in increments of the order of 0.00001 in. Hydrostatic slides also offered good possibilities of providing straight line motions within close limits and with greatly reduced frictional resistance.

Attention was also drawn to the desirability of providing built-in indicating and recording measuring equipment for precision machine tools, to assist operators in producing accurately machined parts. In this connection, particular mention was made of electronic reading equipment, incorporating photo-cells, which provides for monitoring the movements of moiré fringe patterns produced by the relative movement of optical gratings. Such equipment, which had already been brought to an advanced stage of development, could be set up to detect minute changes in the position of a slide.

It was necessary, continued Professor Loxham, that inspection methods and measuring equipment should be improved if very accurate size control was to be maintained. Standards rooms were now in the fortunate position, at last, of having an internationally recognized reference source in the form of a radiation of constant wave-length emitted by a krypton 86 isotope lamp which could, for example, be employed for the detection of errors of size of 1 micro-inch or less in the dimensions of gauge blocks. There was, however, evidence that difficulty was still being experienced in measuring machined parts to a high standard of accuracy, and in support of this contention, the speaker referred to an analysis of test reports submitted independently by a number of firms which had

been asked, in turn, to check the sizes of several gauges. From the figures submitted by the firms, all classed as precision engineering companies, it was found that there were relatively wide discrepancies in the measurement readings obtained by the participating inspectors.

With the advent of machine tools of advanced design it was important to take advantage of the potentialities for precision machining thus afforded by improving the methods employed for work holding, and Professor Loxham suggested that more thought should be given, for example, to the preparation of centre locations in workpieces that were to be precision ground. The use of a small conical grinding wheel driven by a high-speed spindle and following a circular orbit was one method advocated for improving the accuracy of form and the surface finish of centre holes.

### New Works for Arrow Electric Switches

Arrow Electric Switches, Ltd., who specialize in the production of hand-operated and magnetic switches for domestic electric appliances, passenger vehicles, ships, and machine tools, for example, started operations in 1932 at Newton Works, Whitfield Place, London, W.C.2, and the following year occupied premises with a floor area of 10,000 sq. ft. at Hanger Lane, Ealing, W.5. Because of expanding business, extensions to the works were erected on all available land on this site during subsequent

years, and in 1948 the floor space available was 55,000 sq. ft. In 1955, a second factory with a floor area of 25,000 sq. ft. was acquired on the Uxbridge Industrial Estate to house the assembly department for magnetic control gear, and the moulding shop.

The company's activities continued to expand to such an extent that both premises became congested, and in 1960 negotiations were started to acquire a new works at Brent Road, Southall, Middlesex. The new works, which provide a manufacturing area of 200,000 sq. ft., were formally opened recently by Mr. George B. Seawright, executive vice-president of the parent company, Arrow-Hart & Hegeman Electric Co., Hartford, Connecticut, U.S.A. More than 600 people are now employed by the company, and all operations concerned with the production of the entire range of Arrow products are undertaken at the Southall works. A view of the assembly shop for hand-operated switches is given in the accompanying illustration.

### Harper Conference at Willenhall

At a recent conference held at the works of John Harper & Co., Ltd., Willenhall, Staffordshire, some information was given on the company's history from 1790 to the present day, during which period the activities have been expanded from lock and key manufacture to the production of iron castings of various grades and pressings suitable for a diversity of applications.

The works cover an area of 20 acres and provide employment, directly, for some 1,300 people in the various departments. Up to 300 tons of castings, with weights ranging from a few ounces to 1½ tons, are produced each week and, where possible, mechanization is employed for long runs. Many of the skilled moulders are engaged on short-run work and on the production of cast-to-form tools, in Meehanite and S.G. iron, for which a special service has been established. Such



A view of the assembly shop for hand-operated switches at the new Southall works of Arrow Electric Switches, Ltd.

tools find increasing application for deep drawing and pressing, die casting, and rubber moulding. Castings are produced for the machine tool, mining, motor vehicle, aircraft, and railway industries; also for firms engaged in the production of printing machines, agricultural equipment, electric motors, and switchgear. If required, castings may be suitably heat treated; partially or fully machined; and plated, painted or enamelled. Comprehensive laboratory facilities are provided and the services of skilled metallurgists are available.

Those who participated in the conference included engineers and executive staff from companies and organizations with which John Harper and Company have business and other connections. Talks were given by Mr. J. E. Spear and Mr. M. H. Harper on labour relations and on business education in the U.S.A. There was also a short address, during which coloured slides were shown, by the company's industrial design consultant, Mr. P. Bell, whose work has influenced the shape and appearance of many Harper products, including convector heaters, radiant heaters and domestic scales, for example.

There followed a tour of the works to enable activities connected with the casting of Meehanite and other grades of iron to be observed, also the stages involved in the production of a variety of pressings. Methods of achieving economies in the use of labour and materials were pointed out.

### **1,000 Churchill Gear Hobbers**

Churchill Gear Machines, Ltd., Blaydon-on-Tyne, Co. Durham, a company of the Churchill Group, have now built more than 1,000 Rigidhobber gear hobbing machines. The thousandth machine has been supplied to Gresham & Craven, Ltd., Walkden, Manchester, a division of the Westinghouse Brake & Signal Co., Ltd., and will be used by them for the production of components for the Hobbs Mechanematic automatic transmission units for motor vehicles. In the accompanying illustration, Mr. H. A. G. Livock, works manager of the Transmission Department, Gresham & Craven, Ltd., is seen with Mr. J. B. S. Gabriel, chairman of the Churchill Group, at the official handing over of the machine.



The thousandth Rigidhobber built by Churchill Gear Machines, Ltd., has been supplied to Gresham & Craven, Ltd., for use in their new plant for the production of Hobbs Mechanematic transmission units. Mr. H. A. G. Livock, works manager, Transmission Department, Gresham & Craven, Ltd., is here seen (right) with Mr. J. B. S. Gabriel, chairman of the Churchill Group, examining a component produced on the machine. In the background is Mr. Ralph Gabriel, managing director of the Churchill Group, and at the left, Mr. J. Mills, director and general manager, Churchill Gear Machines, Ltd.

This Rigidhobber is one of a large battery of gear machines which forms part of an order for machine tools and other equipment, valued at more than £1-million, to be supplied to the new Gresham & Craven transmission factory by Charles Churchill & Co., Ltd. Details of the Mechanematic transmission and the new factory were given in MACHINERY, 9/990—25/10/61.

### **Fire Damage at P.E.R.A.**

A serious fire occurred at the headquarters of the Production Engineering Research Association of Gt. Britain, Melton Mowbray, on Saturday, October 21, and did extensive damage to the old hunting lodge which has been in continuous use as office and other accommodation since the Association was founded in 1946.

The fire was first seen at about 7 a.m., and at one time the whole of the building was threatened. Four fire brigades fought the blaze, which was only brought under control after about one-third of the building had been seriously damaged. The

affected portion housed the library and offices of senior staff and a number of engineers, also secretarial offices. Fortunately, a substantial part of the building, at the rear, remains undamaged.

The most serious loss to the Association was in the library, where a large number of books and periodicals—many of which are virtually irreplaceable—have been damaged. Salvage work was carried out by P.E.R.A. staff throughout the weekend, and a preliminary estimate puts the cost of the damage to the building and contents at more than £40,000. It is anticipated that restoration of the building will require six months. In the meantime, the library is being temporarily housed in the new extension to the research block.

Every effort is being made to restore P.E.R.A. service to member firms, but for a period, some delays will be inevitable in answering requests for information and providing certain types of technical assistance. Most research and advisory work, however, will not be affected.

### G.T.M.A. Competition

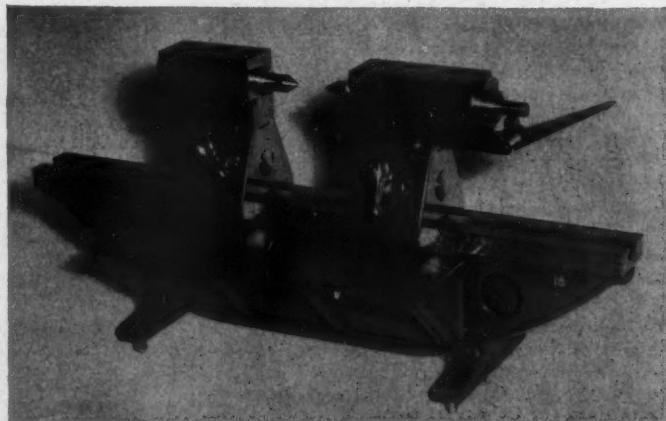
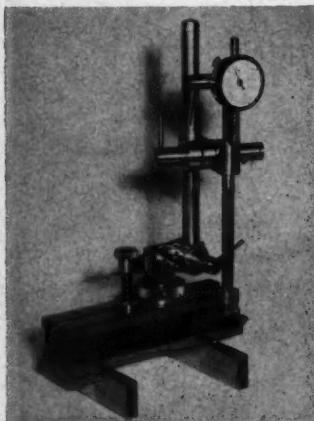
Entries in the 9th Competition in Craftsmanship and Draughtsmanship, organized by The Gauge & Tool Makers' Association, Standbrook House, 2/5 Old Bond Street, London, W.1, were judged recently. The event is organized every alternate year, and, as in the past, the entries, which numbered nearly 120, reached a very high standard in respect of accuracy, finish, and craftsmanship. This competition is arranged by

the Association in order to "give incentive and encouragement to young men who are anxious to attain the highest possible degree of skill in the crafts of gauge and tool-making, also draughtsmanship."

On this occasion, judging took place at the Rugby Works of Associated Electrical Industries (Rugby), Ltd., and the entries were checked and tested in the Inspection Department prior to final examination by two panels of gauge- and tool-making experts. The Association gratefully acknowledges the whole-hearted assistance that has been afforded by A.E.I. (Rugby), Ltd., in making available the Lecture Room for display of the exhibits, and as regards the invaluable work carried out by the Inspection Department. During the adjudication, the Association was honoured by a visit from the Rt. Hon. Viscount Chandos, P.C., D.S.O., M.C., chairman of A.E.I., Ltd.

Entries for the competition are submitted according to various groups laid down by the Association, for example, jigs and fixtures, gauges, cutting tools, press tools, and moulds and dies, and in the craftsmanship section there are two age groups, namely for apprentices—from member firms—under 19, and for those over 19 but under 22. Entries for the draughtsmanship competition are acceptable from competitors under 25.

Winners will be presented with prizes and certificates by Lord Chandos and Sir Stanley Harley, B.Sc., M.I.Mech.E., M.I.Prod.E. (President of the G.T.M.A.), at a luncheon of the Association to be held in London on December 12.



This dial indicator stand and set of bench centres were among the entries in the major open group of the 9th Craftsmanship and Draughtsmanship Competition organized recently by The Gauge and Tool Makers' Association and afford evidence of the high standard which was achieved. Entries this year were housed at Rugby, by kind permission of A.E.I. (Rugby) Ltd.

## Asquith Board Changes

The following changes have been announced in the compositions of the boards of the Asquith Machine Tool Corporation, Ltd., and the companies within the group. ASQUITH MACHINE TOOL CORPORATION, LTD.: Mr. R. W. Asquith has been appointed to the newly-created position of managing director, but will remain chairman of the corporation. WILLIAM ASQUITH, LTD.: In view of the foregoing appointment, Mr. R. W. Asquith has resigned from the post of managing director, but remains chairman of the company. Mr. J. D. H. Horobin and Mr. G. W. Wright have been appointed joint managing directors. Mr. H. Booth has been appointed a director, and will continue as secretary of the company. Mr. J. G. R. Woodvine has resigned from the board, consequent upon the transfer of the Shrewsbury Works of William Asquith, Ltd., to R. Woodvine & Son (Shrewsbury), Ltd., a subsidiary of the corporation, of which Mr. Woodvine is managing director. DRUMMOND BROS., LTD.: Mr. G. E. Fickman is to retire from the chairmanship and joint managing directorship of the company on September 30, 1962. Mr. R. W. Asquith has been nominated to succeed him as chairman, and Mr. C. J. Casben as managing director. Mr. Asquith has therefore resigned the position of joint managing director to become deputy chairman, and Mr. Casben has been appointed joint managing director. Mr. A. D. George and Mr. W. G. Hunt have been appointed directors. DRUMMOND-ASQUITH, LTD.: Mr. J. M. Stewart has been appointed a director, and will continue as secretary of the company. MODERN FOUNDRIES, LTD.: Mr. H. Booth has been appointed a director, and will continue as secretary of the company. ASQUITH ELECTRICS (COLNE), LTD.: Mr. N. Baker has been appointed a director, and will continue as secretary of the company. R. WOODVINE & SON (SHREWSBURY), LTD.: Mr. N. Baker has been appointed a director. GEORGE SWIFT & SONS, LTD., and SWIFT-SUMMERSKILL, LTD.: Mr. J. Carter is retiring from the position of chief engineer after 36 years' service, but will remain a director of these companies, and will be available in a consultative capacity.

## Machine Tool Fair in Japan

In MACHINERY 99/994 reference was made to the International Machine Tool Fair which is to be held in Osaka in October, 1962. It has been pointed out to us that the figures given for applications from various countries (West Germany 247, U.S.A. 240, United Kingdom 227, etc.) may be misinterpreted. All these figures, of course, relate to stand units of 9·8 by 8·2 ft., and not to numbers of applications from different companies.

## MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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## Industrial Notes

**BLACK & DECKER, LTD.**, Harmondsworth, Middlesex, announce that they have now completed the acquisition of Star, the Italian electric power tools company.

**MONTGOMERIE REID ENGINEERING CO., LTD.**, Bramley Green, Basingstoke, Hants., have taken over R. H. Corbett & Co., Ltd., Rochester, Kent, and will now build and sell the complete range of trucks made by the latter company.

**CHARLES CHURCHILL & CO., LTD.**, Coventry Road, South Yardley, Birmingham, have recently formed a subsidiary, Dorsett Marine, Ltd., for importing from the U.S.A., and manufacturing in this country, the Dorsett range of boats.

**THE BRITISH MANUFACTURED BEARINGS GROUP** of Companies, Crawley, Sussex, inform us that their telephone number has been changed to Crawley 28765 (9 lines). The firms in question are British Manufactured Bearings Co., Ltd., B.M.B. (Sales), Ltd., John Bass, Ltd., S.B.V. (Coldheading), Ltd., and Boscombe Press, Ltd.

**THE ENGINEERING INDUSTRIES ASSOCIATION**, West London and Luton/Beds. Groups, will hold a one-day display at the Town Hall, Watford, on November 30, from 2.30 to 9 p.m. It will be officially opened at 3 p.m. by the President of the Association, Lord Davidson, G.C.V.O., C.H., C.B.

**COMBINED ENGINEERING & ECONOMIC STUDIES, LTD.**, is the title of new organization which has been set up, with offices at 1-2 Finsbury Square, London, E.C.2. to provide a consulting service, based on advanced engineering and economic techniques, to "survey engineering, economic, and financial potential in any country, and examine projects and plans of many different kinds."

**INA NEEDLE BEARINGS, LTD.**, Llanelli, have opened a new London office at 232 Tolworth Rise South, Surbiton, Surrey (telephone Derwent 0161). This office is under the management of Mr. D. G. Galpin, A.M.I.Prod.E., and will serve the London area and South and South West England. A free technical service is offered which covers assistance with design and advice on production problems.

**DISTINGTON ENGINEERING CO., LTD.**, a subsidiary of The United Steel Companies, Ltd., The Mount, Broomhill, Sheffield, 10, report that deliveries from their iron foundry reached the record total of 111,723 tons for the year ended September 30. Exports of finished castings, such as ingot moulds, to Continental steelworks accounted for a substantial proportion of the total.

**FLEXILE METAL CO., LTD.**, Bessemer Drive, Stevenage, Herts., inform us that they have been appointed sole agents in this country for Costruzioni Automatiche Martelli (CAM) of Bologna, Italy. Publications are available describing various products of this company which include automatic cartoning machines, a filling and cartoning machine, a wrapping and sealing machine, and a wrapping and cartoning machine. It is stated that full after sales service for these machines will be provided.

**BRITISH STANDARD SPECIFICATION 3403:1961** is concerned with indicating tachometers for industrial use. The standard specifies scale ranges, scales, constructional details, marking, performance and tests, for three grades of tachometers, with nominal accuracies of  $\pm 0.75$ ,

$\pm 1.5$  and  $\pm 3.0$  per cent of the maximum scale value. Copies of this standard may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London, W.1. (Price 6s. each, postage extra to non-subscribers.)

**METAL FINISHING PAPER COMPETITION.** The Institute of Metal Finishing, North West Branch, are to hold an international students' competition (age limit is 25 years). Competitors will be required to submit papers on a subject "allied to the art and science of metal finishing" which may range from "the academic to the most practical". Particulars and entry forms can be obtained from the Hon. Secretary, Mr. F. Spicer, Suffield Cottage, Moorhead, Gildersome, near Leeds.

## Machine Tools from Hungary

In connection with the article on Eastern Bloc Machine Tools which appeared in MACHINERY 99/861—11/10/61, it has been pointed out to us that the paragraph concerned with Hungary may have been somewhat misleading. Times Machinery Co., Ltd., Poyle Road, Colnbrook, Slough, Bucks., inform us that they are importing a wide range of Hungarian machine tools and that the following are available for inspection and demonstration under power at their showrooms near London Airport. An E2N tool-room lathe; E.400 head sliding, surfacing, and screw-cutting lathes; MVE.280M heavy duty lathes; MF.1000 and VF.222 vertical milling machines; and UF.231.A universal milling machines.

## BESTEC Exhibition in Budapest

An exhibition of high precision measuring instruments and engineering tools is to be staged in Budapest from November 20 to December 3, inclusive, by British Engineers Small Tools & Equipment Co., Ltd., 6 Buckingham Street, London, W.C.2, and the following member companies: Coventry Gauge & Tool Co., Ltd., Brooke Tool Mfg. Co., Ltd., Hilger & Watts, Ltd., Sigma Instrument Co., Ltd., British Indicators (Sales), Ltd., L. M. Van Moppes & Sons (Diamond) Tools, Ltd., and Joseph Gillott & Sons. It will be held in the showroom of Metrimpex (the Hungarian Trading Company for Instruments) at Kosuth Lajos ter, 9, Budapest V, and will be open daily from 9 a.m. to 6 p.m. The general public will be admitted and invitations are being sent to officials, scientists, engineers, technicians, and educationalists.

## Red Ring Selling Arrangements

Wickman, Ltd., Banner Lane, Coventry, have concluded an agreement with Precision Gear Machines & Tools, Ltd., Bodmin Road, Coventry, whereby they will have the exclusive selling rights within the United Kingdom for all British-built Red Ring products, including gear shaving, honing, and checking machines and equipment, gear shaving cutters and honing tools, and British-built Lees-Bradner gear hobbing machines.

In addition, Wickman, Ltd., become sole concessionaires within the United Kingdom for all Red Ring machines and equipment made by the parent firm—National Broach & Machine Co., Detroit 13, Michigan, U.S.A.

## Equating Incentive with Good Industrial Relations

(Continued from page 1003)

The primary object of this scheme was to provide a more equitable method of distributing reward in proportion to the overall results obtained, and thus ensure that the incentive system did not contain within itself the seeds of dissatisfaction. In this respect, we understand, it has proved notably successful, and has had the effect of promoting a corporate interest in the activities and efficiency of the company, which has largely displaced the more self-interested philosophy which inevitably resulted from the piece-work system previously employed. It does not follow, of course, that the plan would be suitable for general application in manufacturing industry—at least without some modifications—but the advantages which it has conferred and the attention it has attracted, suggest that there is a widespread need for re-examination of the bases of incentive remuneration. In conclusion, it must be emphasized that the spirit in which any such plan is introduced and received may be of more importance than the practical details.

## Coming Events

**INSTITUTION OF PLANT ENGINEERS. Western Branch.** November 8, at 7.15 p.m., at the Grand Hotel, Broad Street, Bristol; lecture on "Organization of Planned Maintenance", by H. Bamford-Preston.

**INSTITUTION OF PRODUCTION ENGINEERS. Halifax and Huddersfield Section.** November 13, at 7.30 p.m., at Percival Whitley College of Further Education, Francis Street, Halifax; lecture on "Design and Development of Machine Tools," by C. A. Sparkes. **Ipswich and Colchester Section.** November 10, at 7.30 p.m., at Davey, Paxman & Co., Ltd., Britannia Works Canteen, Colchester, Essex; lecture on "Packing," by J. E. Evan-Cook. **Wolverhampton Section.** November 8, at 7.15 p.m., at Wolverhampton & Staffs. College of Technology; lecture on "Industrial Research in Britain," by P. Spear B.Eng. **Preston Section.** November 8, at 7.30 p.m., at The Harris College, Corporation Street, Preston; lecture on "Spark Erosion," by P. J. C. Gough. **Edinburgh Section.** November 8, at 7.30 p.m., at the North British Hotel, Princes Street, Edinburgh; lecture on "Flow Turning," by E. J. Bennett.

**INSTITUTION OF ELECTRICAL ENGINEERS. Scottish Electronics and Measurement Group.** November 13, at 6 p.m., at the Royal College of Science and Technology, Glasgow; lecture on "Numerical Control of Machine Tools," by D. F. Walker, B.Sc.

**INSTITUTION OF ENGINEERING DESIGNERS. North-east Branch.** November 13, at 7.15 p.m., in the New Lecture Theatre, Rutherford College of Technology, Northumberland Road, Newcastle upon Tyne 1; lecture on "A National

Standard in Engineering Design Education," by W. A. A. Witham.

**INSTITUTION OF MECHANICAL ENGINEERS. Industrial Administration and Engineering Production Group.** November 8, at 6 p.m., at the Institution, 1 Birdcage Walk, Westminster, London, S.W.1; discussion on "Mechanical Handling of Small Parts with Special Reference to Automatic Assembling Equipment."

## Obituary

**MR. GEORGE ADCOCK, M.I.Prod.E.**, chairman and founder of Adcock & Shipley, Ltd., Ash Street, Leicester, died recently.

**MR. G. A. TROW**, works director of Abwood Machine Tools, Ltd., Princes Road, Dartford, Kent, died suddenly on October 18.

**CAPTAIN J. F. SCOTT**, of Southern Engineering & Machinery Co., Millbrook, Southampton, died on October 27 at the age of 68. He had been with the company for 15 years.

**MR. JOSEPH COOKSON**, founder and proprietor of Cookson's, Orchard Works, 45 George Lane, South Woodford, London, E.18, died recently at the age of 66, while convalescing after a short illness.

## Scrap Metals

**MIDLANDS.**—Movement of scrap to steelworks is still very restricted and Midlands consumers are only taking limited tonnages of grades No. 1 and 2 heavy steel. Merchants can invariably fulfil these deliveries in one or two days early in each week, and all other material forthcoming is put into stock at their yards. No. 4 bales have not been moving freely because of the situation in South Wales.

Supplies of blast furnace scrap are also very hard to place as both turnings and bales are only accepted under strict allocations. The restricted hours of working in some sections of the motor trade has reduced the output of processed scrap, and merchants have therefore been less embarrassed than would otherwise have been the case, in finding outlets for such material.

The situation as regards foundries is similar to that at steelworks, with acceptances at a low level. Stocks of short heavy steel are being kept down to a minimum, and there are very few outlets for general sheared scrap. Offers to supply at reduced prices have not resulted in increased allocations.

Some of these difficulties should be alleviated now that the export of scrap of certain grades is permitted under open general licence.

Cast iron scrap continues to move reasonably well, but there are indications that some Midland consumers are better placed for supplies particularly as regards the lighter grades.

Parcels of high-speed steel scrap and turnings are quickly taken up at prices of the order of 1/11½d. per lb. for solid and 1/5d. per lb. for turnings.

Light scrap for pressing is being moved, but prices will remain comparatively low until firm export orders are obtained for baled scrap.

## Machine Tool Share Market

The strength and activity of British Government stocks, and home corporation and Dominion loans, provided the outstanding feature of stock markets during the period under review.

Except in this section, business showed no appreciable expansion, but a fairly steady tone was maintained in nearly all markets, with the tendency, on the whole, towards improvement.

Interest in commercial and industrial shares remained moderate and selective, and movements among prices generally were irregular. Good features were not lacking, however, and a certain number of modest gains was shown on balance.

Among machine tool issues Edgar Allen advanced 3d. to 31s. 9d.; Arnott & Harrison, 1s. 6d. to 11s. 6d.; British Oxygen, 1s. to 15s. 6d.; Craven Bros. (Manchester), 7½d. to 7s. 9d.; Kerry's (Gt. Britain), 3d. to 7s. 9d.; and Samuel Osborn, 3d. to 46s. 6d. On the other hand Birmingham Small Arms lost 6d. at 19s. 6d.; Chas. Churchill, 1d. at 8s. 3d.; Geo. Cohen, 6d. at 9s. 6d.; Greenwood & Batley, 1s. at 14s. 3d.; Alfred Herbert, 6d. at 59s. 6d.; John Holroyd "B", 6d. at 15s. 9d.; A. A. Jones & Shipman, 6d. at 25s.; Sanderson Kayser, 1s. 3d. at 33s. 9d.; Stedall &

Co., 3d. at 7s. 6d.; W. E. Sykes "B," 1s. 4½d. at 24s. 3d.; and Thos. W. Ward, 1s. at 66s. 6d.

KERRY'S (Gt. BRITAIN), LTD. Int. div. 3½ per cent.

## Presentation to Mr. C. M. Cohen

Mr. Cyril M. Cohen, chairman and managing director of the George Cohen 600 Group, Ltd., was presented with a silver and enamel cigarette box by employees of the group on October 18, to mark his completion of 45 years of service with the organization. The presentation was made by Mr. D. W. Cooper, a director of George Cohen, Sons & Co., Ltd., at the headquarters of the group at Wood Lane, London, W.12. Some sixty people were present and included directors, executives and workpeople from the 36 companies of the group at home and overseas, and those attending were selected by ballot. It may be of interest to mention that the cigarette box, which was made by Garrard & Co., Ltd., has been approved as a work of art by the panels of the Design Research Centre and the Crafts Centre of Great Britain. In addition to the box, Mr. Cohen was given a commemorative volume containing the names of the 1,400 subscribers to the gift and a cheque which is to be sent to a charity to be selected by him.

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.	Ord.	1/-	1/3	Herbert (Alfred), Ltd.	Ord.	£1	59/6
Allen (Edgar) & Co., Ltd.	Ord.	£1	31/9	" A " Ord.	5/-	20/-	
	5% Prf.	£1	13/3	" B " Ord.	5/-	15/9	
Arnott & Harrison, Ltd.	Ord.	4/-	11/6	Jones (A. A.) & Shipman, Ltd.	Ord.	5/-	25/-
Asquith Machine Tool Corp., Ltd.	Ord.	5/-	10/-	Kearny & Trecker-C.V.A., Ltd.	7½% Cum. Prf.	5/-	4/6
	6% Cum. Prf.	£1	16/6		5½% Red. Prf.	£1	8/9
Birmingham Small Arms Co., Ltd.	Ord.	10/-	19/6	Kearns (H. W.) & Co., Ltd.	Cum. Prf.	£1	13/9
" " "	5% Cum.	£1	12/6	Kerry's (Gt. Britain), Ltd.	Preid. Ord.	£1	21/3
" " "	A" Prf.	£1	15/6	Macready Metal Co., Ltd.	Ord.	5/-	7/9
" " "	6% Cum.	£1	16/6	Martin Bros. (Machinery), Ltd.	Ord.	5/-	15/-
" " "	B" Prf.	£1	17/6	Massey (B. & S.), Ltd.	Ord.	2/-	2/6
" " "	4% 1st Mort.	Stk.	91½		Ord.	5/-	11/-
British Oxygen Co., Ltd.	Ord.	5/-	15/6	Newall Engineering Co., Ltd.	Ord.	2/-	7/-
" " "	6% Cum. Prf.	£1	18/6	Newman Industries, Ltd.	Ord.	2/-	7/-
Brooke Tool Manufacturing Co., Ltd.	Ord.	5/-	24/-	Noble & Lund, Ltd.	6% Prf. Ord.	5/-	5/-
Broom & Wade, Ltd.	Ord.	5/-	24/-	Norton, W. E. (Holdings), Ltd.	Ord.	2/-	4/-
Brown (David) Corporation, Ltd.	5½% Cum. Prf.	£1	16/6	Osborn (Samuel) & Co., Ltd.	Ord.	5/-	46/6
Buck & Hickman, Ltd.	6% Cum. Prf.	£1	14/-		5½% Cum. Prf.	£1	22/2
Butler Machine Tool Co., Ltd.	Ord.	5/-	15/-	Pratt (F.) Engineering Corporation, Ltd.	Ord.	5/-	14/6
" " "	5% Cum. Prf.	£1	12/6	Sanderson Kayser, Ltd.	Ord.	10/-	33/9
" " "	Ord.	2/-	8/3	" " "	6½% Cum. Prf.	£1	16/3
Churchill (Charles) & Co., Ltd.	6% Cum. Prf.	£1	25/7½	" " "	Ord.	4/-	7/3
" " "	Ord.	1/-	6/3	Scottish Machine Tool Corporation, Ltd.	Ord.	£1	50/7½
Clarkson (Engrs.), Ltd.	6% Cum. Prf.	£1	11/3	Shardlow (Ambrose) & Co., Ltd.	Ord.	5/-	14/7½
" " "	Ord.	1/-	2/6	Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	£1	19/-
Cohan (George), 600 Group, Ltd.	Ord.	5/-	9/6	Sheffield Twist Drill & Steel Co., Ltd.	5% Cum. Prf.	£1	13/3
" " "	4½% Cum. Prf.	£1	11/6	Stedall & Co., Ltd.	Ord.	5/-	7/6xd
Coventry Gauge & Tool Co., Ltd.	Ord.	10/-	29/4½	" " "	" B " non-voting Ord.	10/-	24/3
" " "	5% Cum. Red. Prf.	£1	16/3	Tap & Die Corporation, Ltd.	Ord.	5/-	16/3
Craven Bros. (Manchester), Ltd.	Ord.	5/-	7/9	" " "	4½% Deb. 1961-1977	Stk.	8/½
Elliots (B. & S.), Ltd.	Ord.	1/-	2/6	Wadkin, Ltd.	Ord.	10/-	26/-
" " "	4½% Red. Cum. Prf.	£1	11/3	Ward (Thos W.), Ltd.	Ord.	£1	66/6
Firth Brown Tools, Ltd.	4% Cum. Prf.	£1	10/-	" " "	5% Cum.	£1	13/6
Greenwood & Batley, Ltd.	Ord.	10/-	14/3	1st Pref.	5% Cum.	£1	20/-
Harper (John) & Co., Ltd.	Ord.	5/-	7/9	" " "	2nd Pref.	Ord.	1/-
" " "	4½% Red. Cum. Prf.	£1	10/-	Willson Lathes, Ltd.			3/-

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error. \* Sheffield price. £ Birmingham price.

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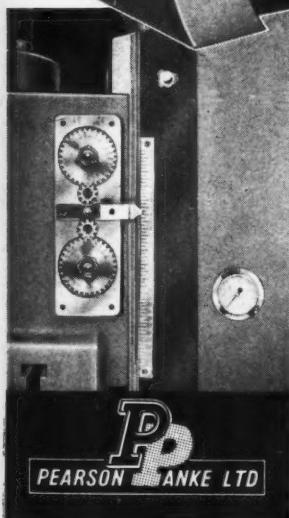
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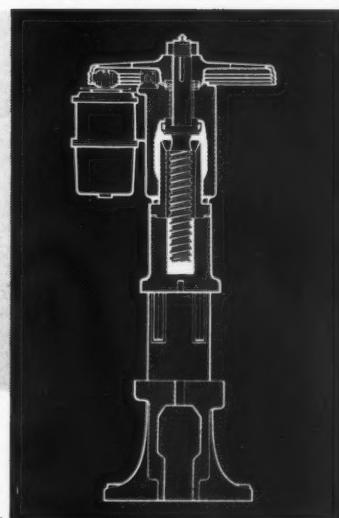
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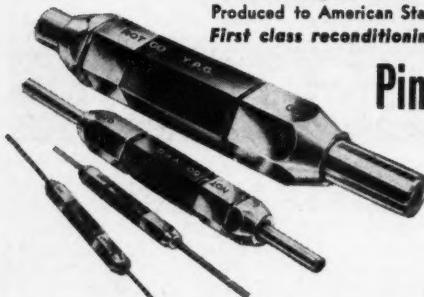




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Photo courtesy of Leeds University

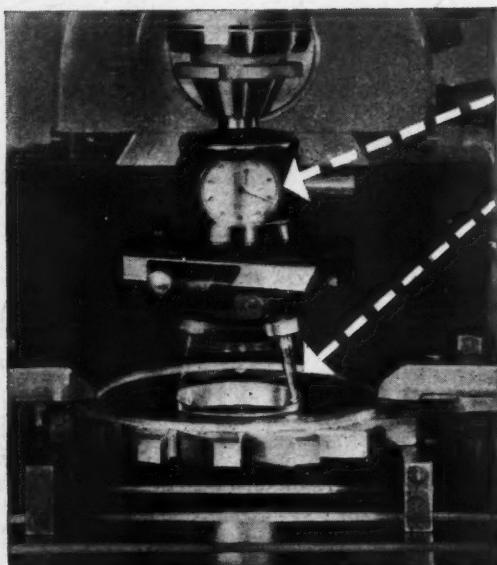
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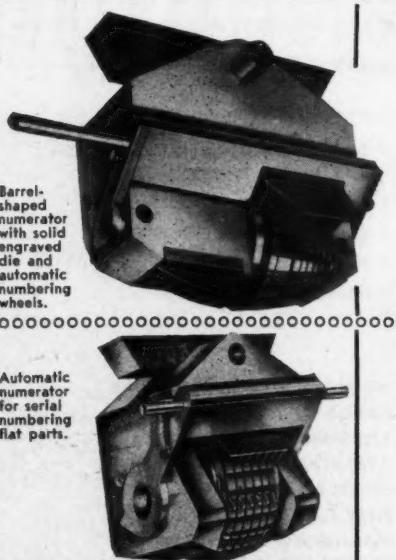
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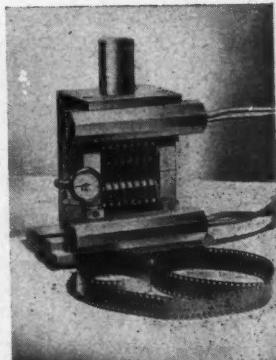
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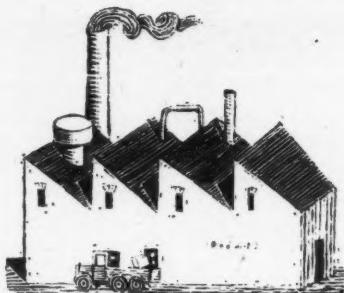
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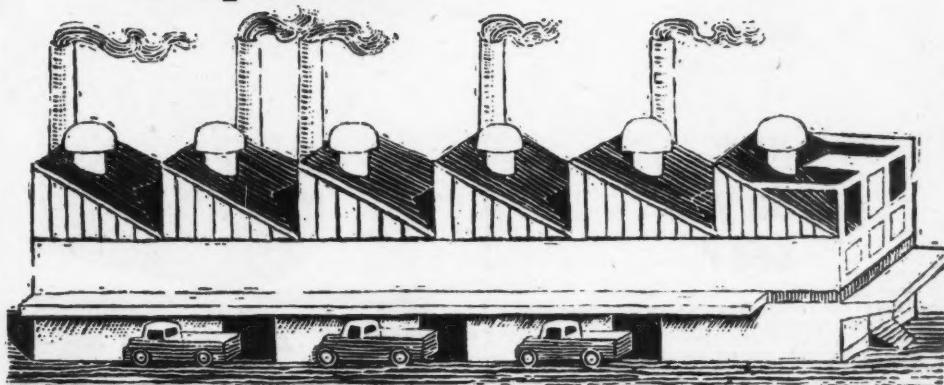
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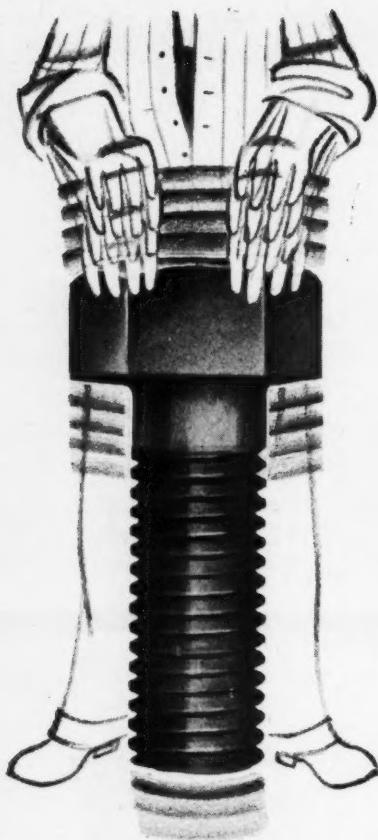
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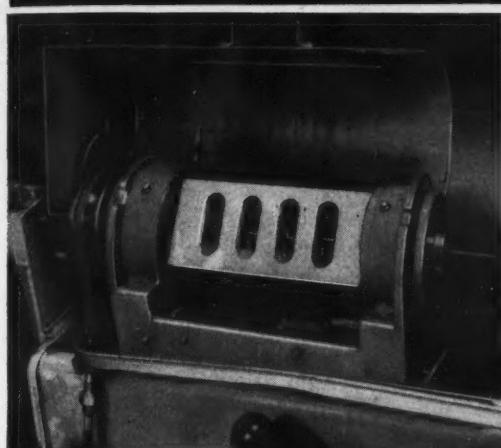
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Tel: Trafford Park 0663/4 Grams: HUNTING, MANCHESTER 16

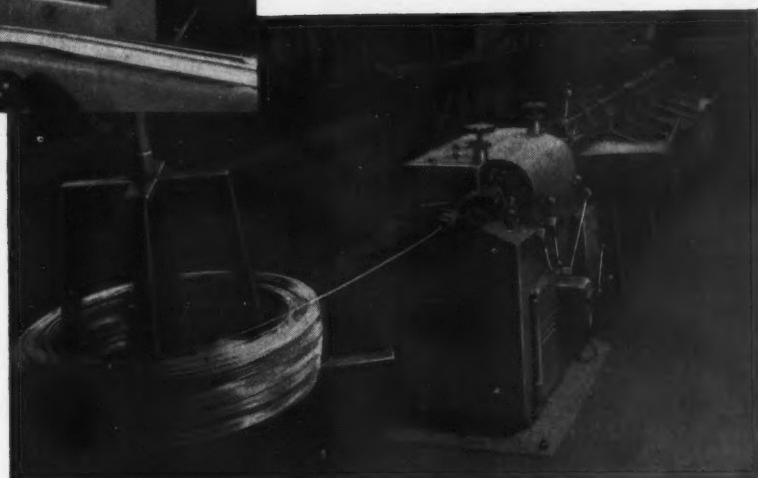
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***Accurate, High Speed  
Straightening and  
cutting off with the  
M.R & P Type RA  
machine***

Photograph  
by courtesy of  
Rylands Bros. Ltd.  
Warrington



## **at Rylands Bros., Ltd**

continuous use on wire ranging from 8-21 S.W.G. Rylands Bros. have a number of RA machines of various sizes installed in their Works and particularly appreciate their reliability on high speed work to close tolerances.

The RA4 machine is one of seven sizes to handle wire from 0.020in. to 11/16in. dia. in a wide range of materials. Setting up is simple and quickly accomplished, therefore change-over times are short.

To ensure maximum efficiency on every type of wire, six feed rates and two spinner speeds are provided. Two simplified models with steplessly variable drive types RB4 and RB6 are now also available.

For Electrode Manufacturers requiring the highest possible output, there is a special model RAE6, operating at up to 320 cuts per minute with the greatest precision.

RA, RB and RAE Wire Cutting-off Machines are made by Meyer, Roth & Pastor of Cologne. They are sold and serviced in the United Kingdom by the Sole Selling Agents

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SOAG MACHINE TOOLS LTD

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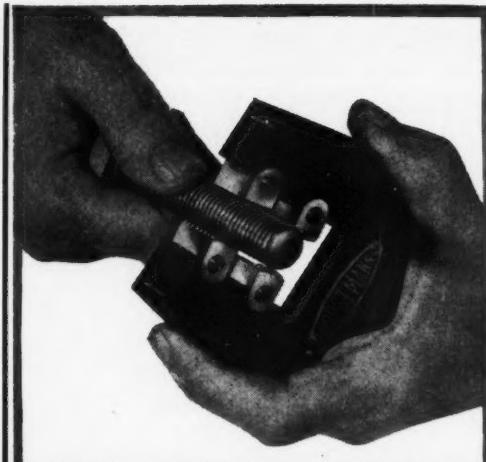
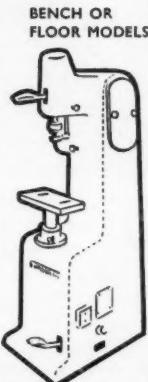
- ★ High quality precision machines at reasonable cost.
- ★ Capacity . . . . .  $\frac{1}{2}$  in. in steel.  
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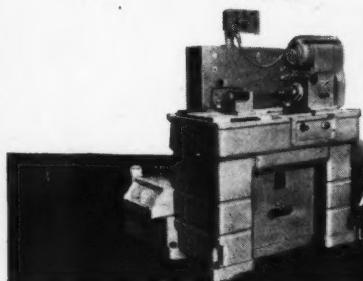
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The machine is one of an established range of honers manufactured at our Leicester works by agreement with MICROMATIC HONE CORPORATION.

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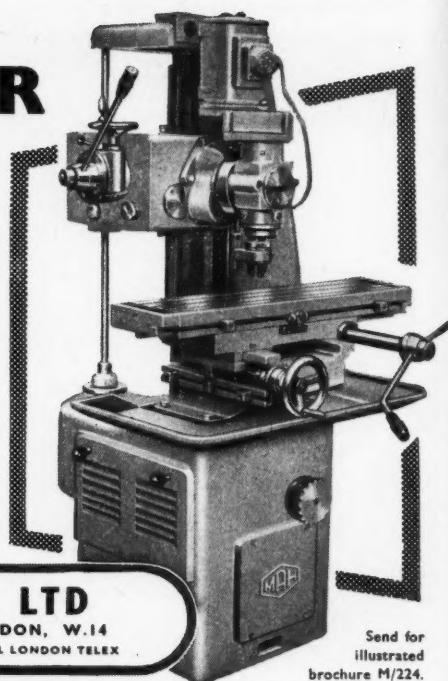
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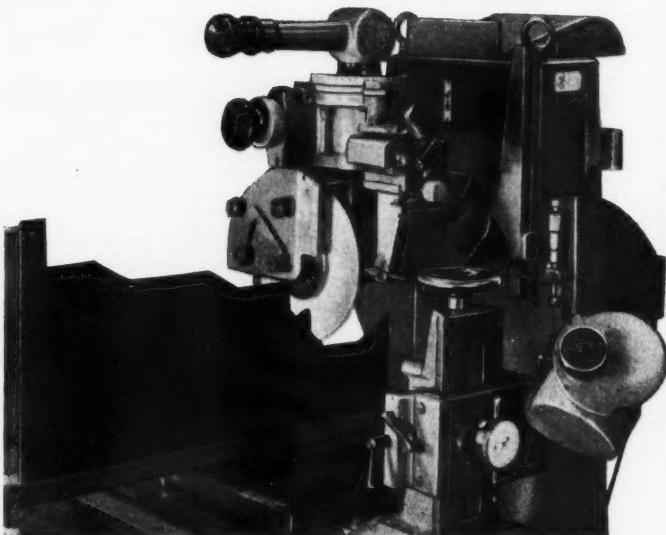
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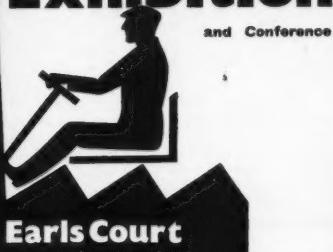
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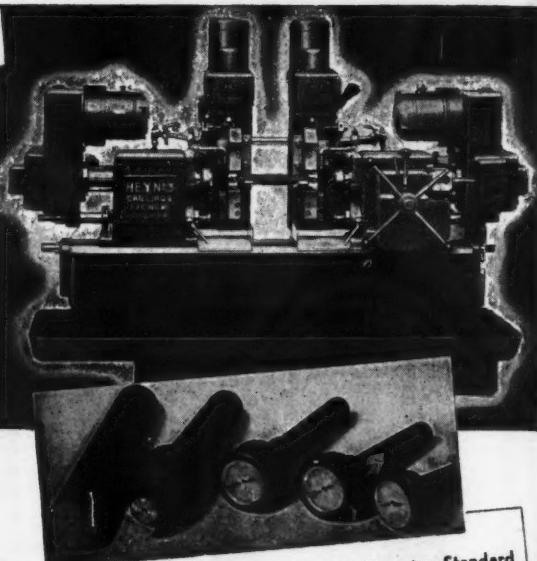
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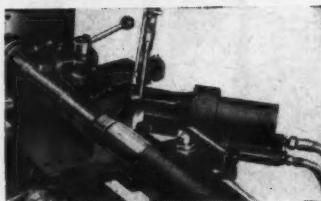
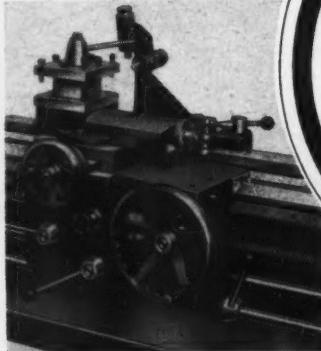
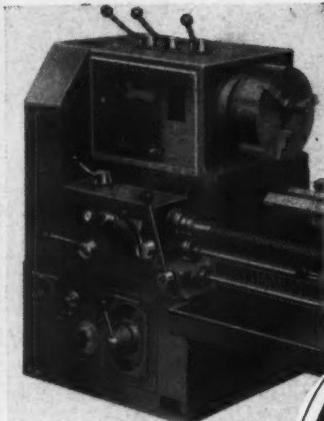
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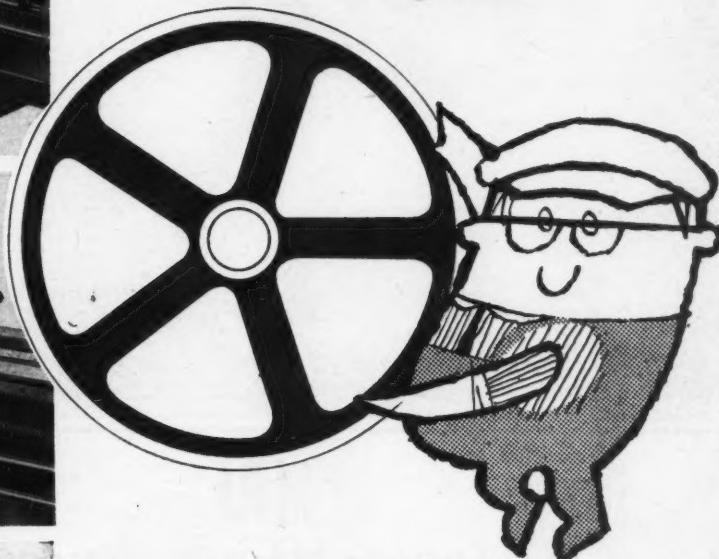


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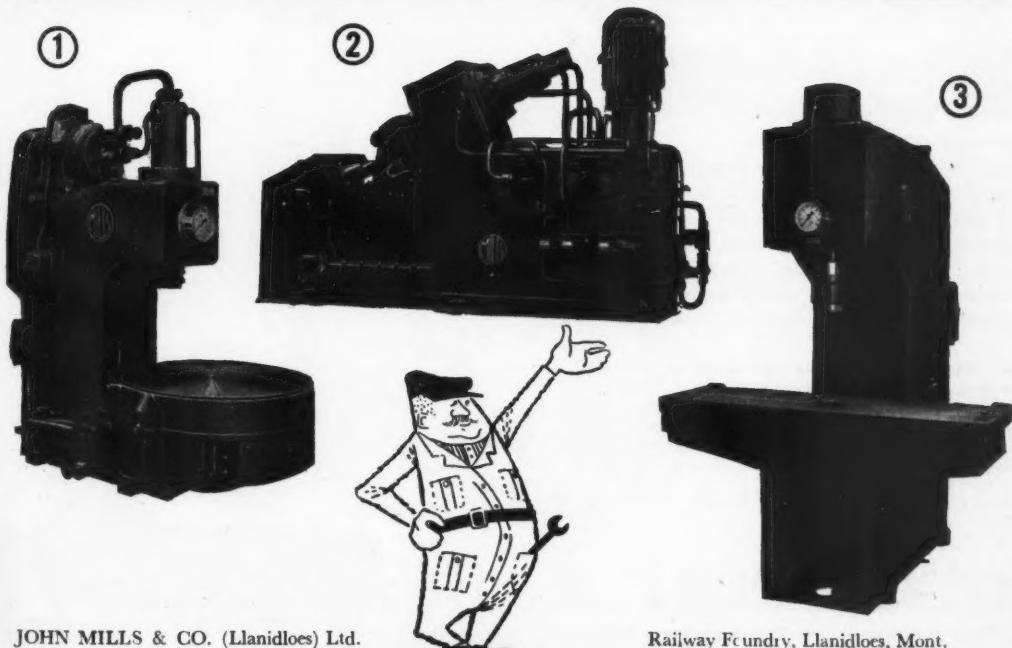
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If it's a question of how, when and where to press, consult our design staff—they are specialists in originating methods of manufacture and assembly for higher productivity. From their wide experience they may produce a ready-made answer—and even a ready-made press (from our standard range). Alternatively a specially designed and built press may provide the ideal answer in much less time than you'd think possible!

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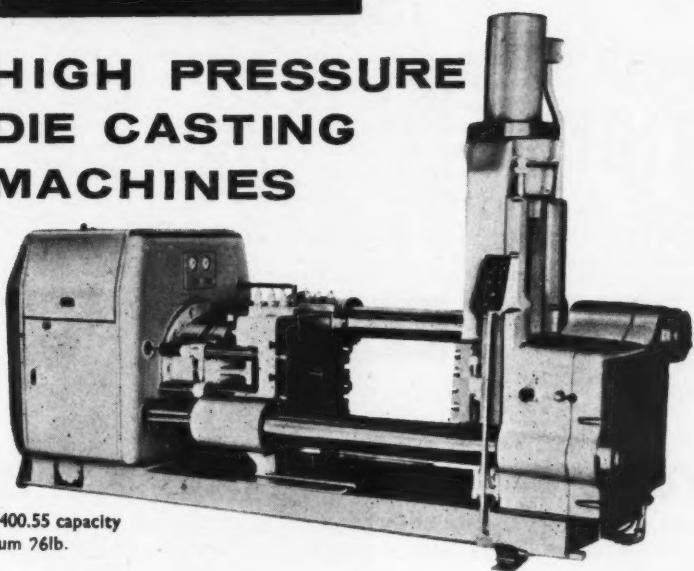
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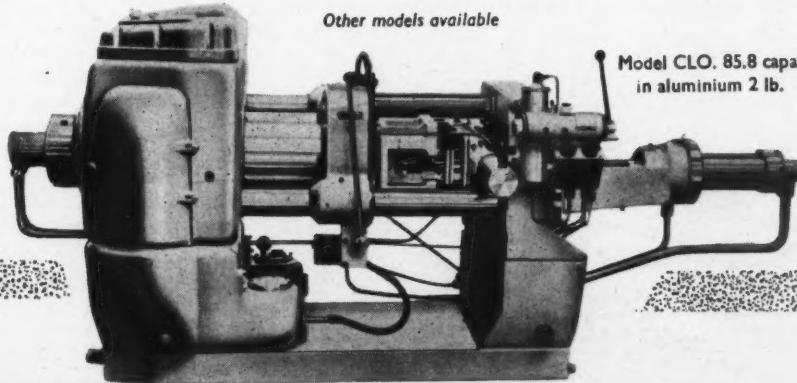
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Model CLP. 400.55 capacity  
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- Semi-automatic control
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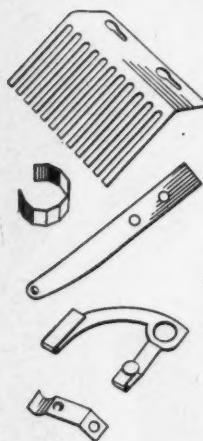


Model CLO. 85.8 capacity  
in aluminium 2 lb.

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**MACHINE TOOL COMPANY LIMITED**

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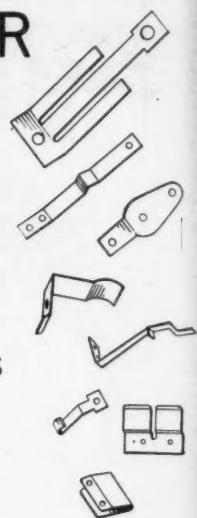


for strip-formed piece parts of all kinds because it combines all the advantages of a copper-base alloy, such as easy formability and high electrical conductivity, with the high tensile strength, fatigue resistance and hardness usually associated with high grade steels. Beryllium Copper strip is generally fabricated into complicated shapes from annealed, quarter or half-hard rolled material prior to hardening to spring temper by simple heat treatment.

THE BEST BERYLLIUM COPPER IS

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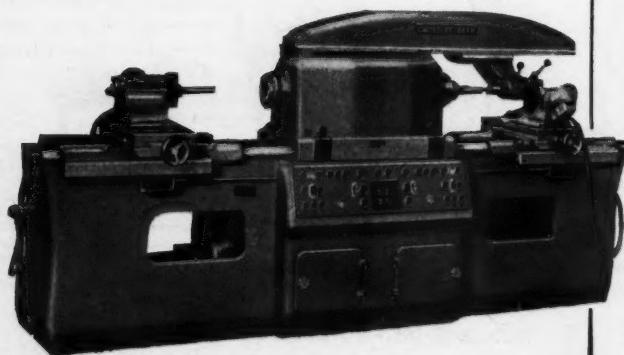
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with powerful (but easily operated) locks, giving a virtually solid arm and column with minimum deflection at high penetration rates.

**BOX TYPE TABLE**  
for maximum capacity and rigidity, with minimum deflection. Quickly removable.

**AMPLE POWER**  
Constant-torque motor combined with back gear giving max. 3 h.p. when most needed.

**FINGER LIGHT CONTROLS**  
Speed and feed changing, starting, stopping, reversing, power elevation of column, all operate with effortless ease.

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**MODEL SV 140A**  
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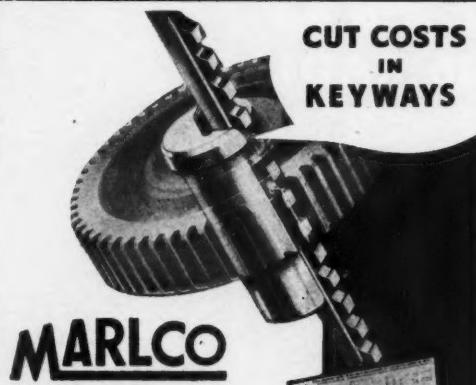
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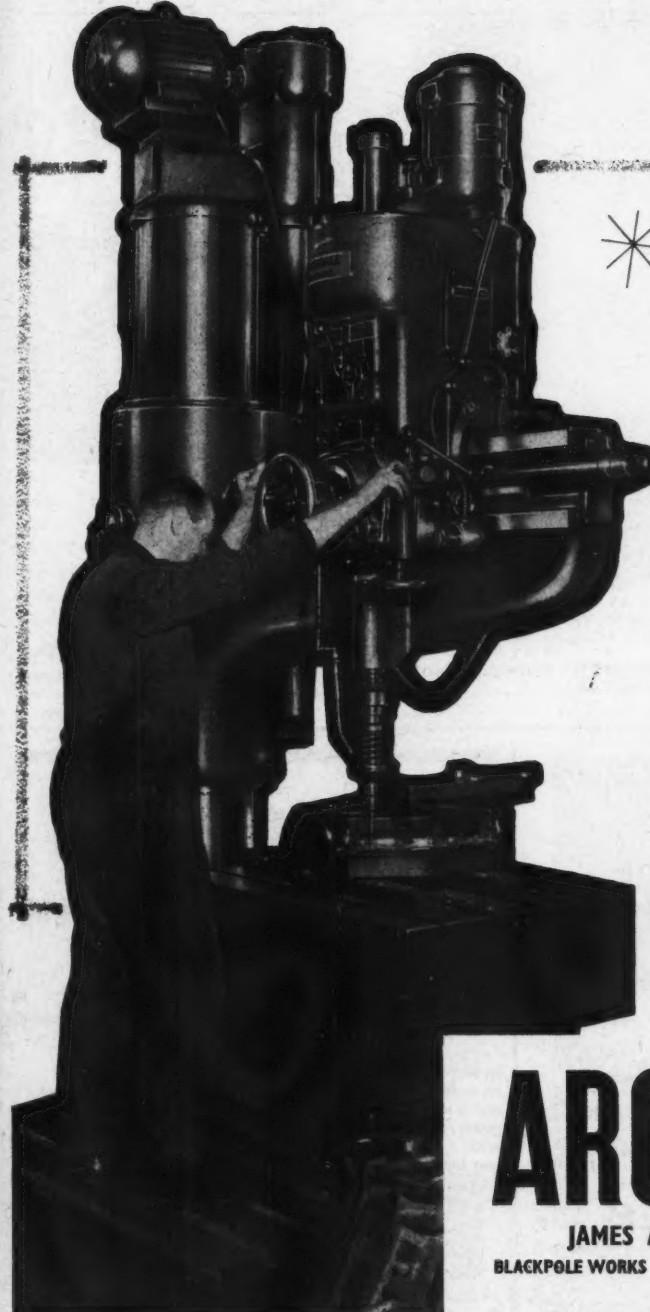
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"Cut perfect taper or parallel Keyways with any type of hand press, without skilled labour or elaborate set up. No. 0 Set for  $\frac{1}{8}''$ - $\frac{1}{2}''$  with guide diameters  $\frac{1}{2}''$ - $\frac{3}{4}''$ . No. 1 set for  $\frac{1}{4}''$ - $\frac{1}{2}''$ , with guide diameters  $\frac{1}{4}''$ - $\frac{1}{2}''$ . No. 2 Set for  $\frac{1}{4}''$ - $\frac{3}{4}''$ , with guide diameters  $\frac{1}{4}''$ - $\frac{1}{2}''$ . No. 3 Set for  $\frac{1}{2}''$  and  $\frac{3}{4}''$ , with guide diameters  $2''$ - $3\frac{1}{2}''$ . Broaches and guides are interchangeable for non-standard Keyways."

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ARCHDALE high speed radials have 17 spindle speeds, from 15 to 1,500 r.p.m. with six or twelve feeds. Normal drilling capacity is up to 3in. diameter in mild steel. Sizes range from 3ft. 3in. to 8ft. spindle radius.

Many other models are available from light type to heavy duty hydraulic pre-select radials.

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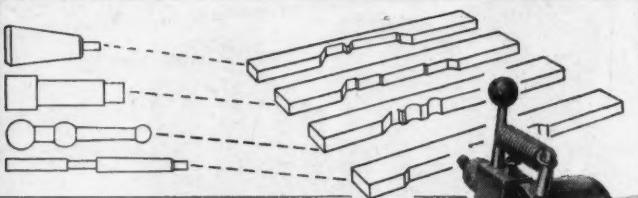
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... at low cost

- ★ Low initial outlay recovered in a few weeks.
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ZINC B.S. 1004 OR ALUMINIUM  
LARGE OR SMALL

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**T.A.L. DEVELOPMENTS LTD.**

BROADWATER WORKS, GARMAN ROAD, TOTTENHAM, N.17  
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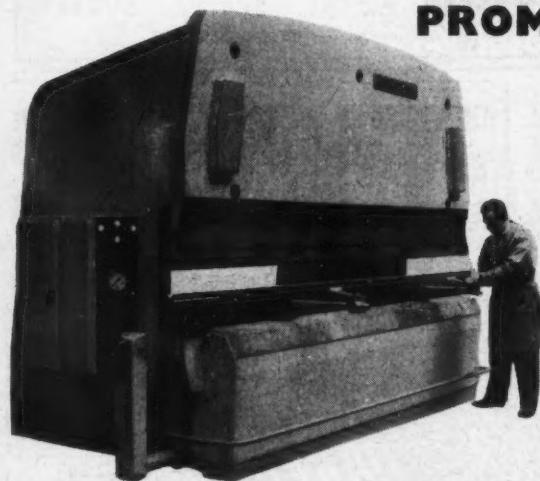
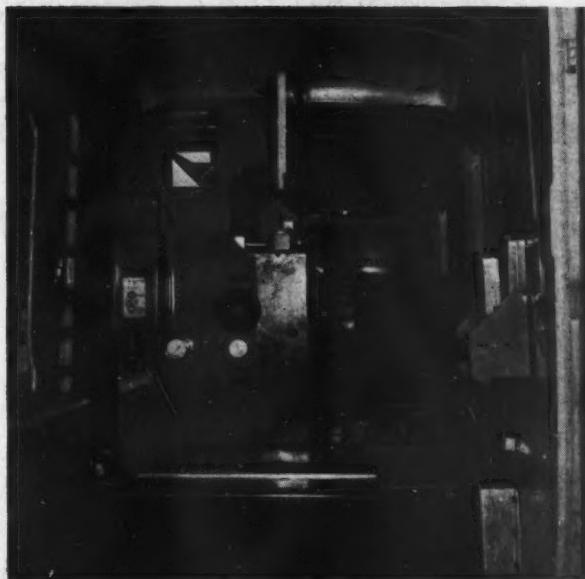
**• .0003" tolerance  
does NOT mean  
• .003" tolerance ...**

In our full page advertisement on October 18th an unfortunate typographical error occurred and a microhoning process which, in fact, generates sphericity within '0003" tolerance with a controlled microinch finish of 6-10 R.M.S. was incorrectly quoted as '.003" tolerance. Fortunately the headline was correct but for the discerning reader we hasten to remedy this error

**A. A. JONES & SHIPMAN LTD.,**  
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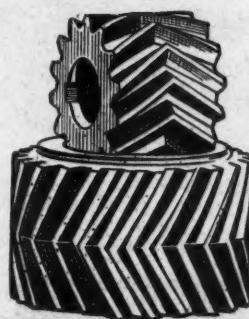
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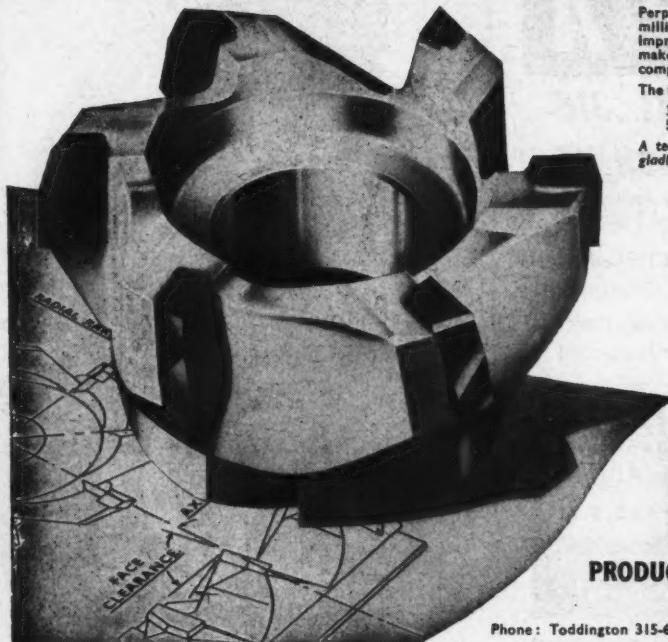
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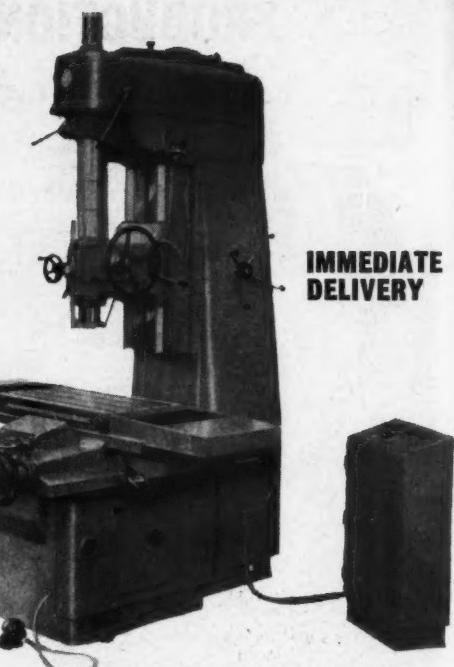
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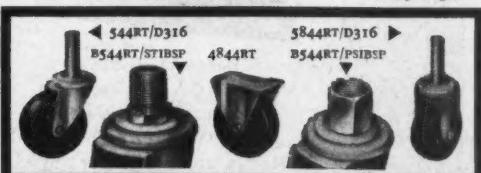
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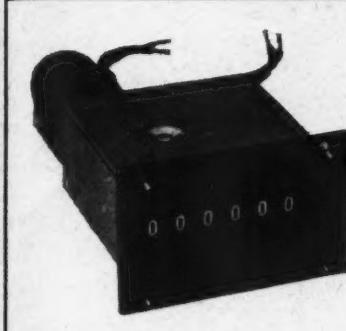
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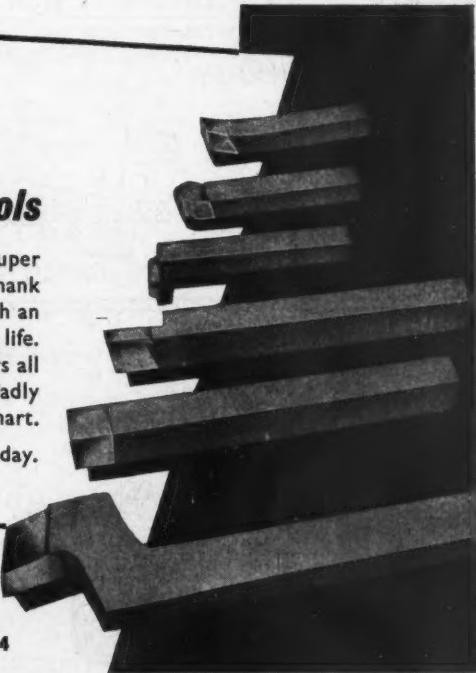
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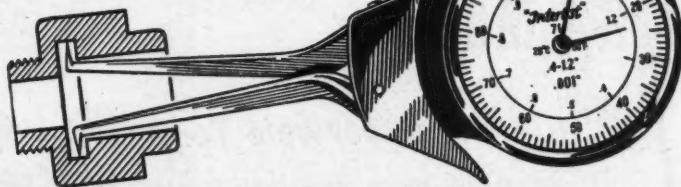
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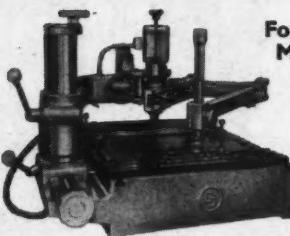
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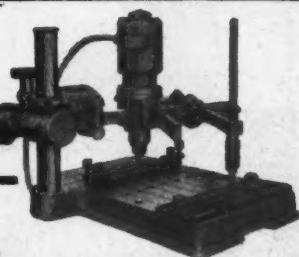
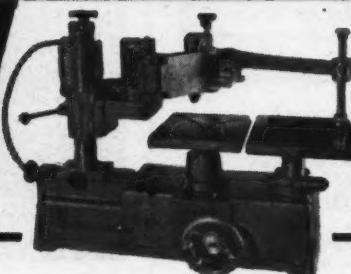
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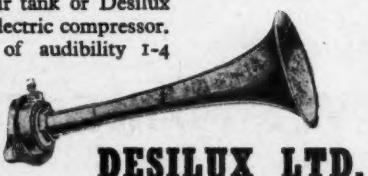
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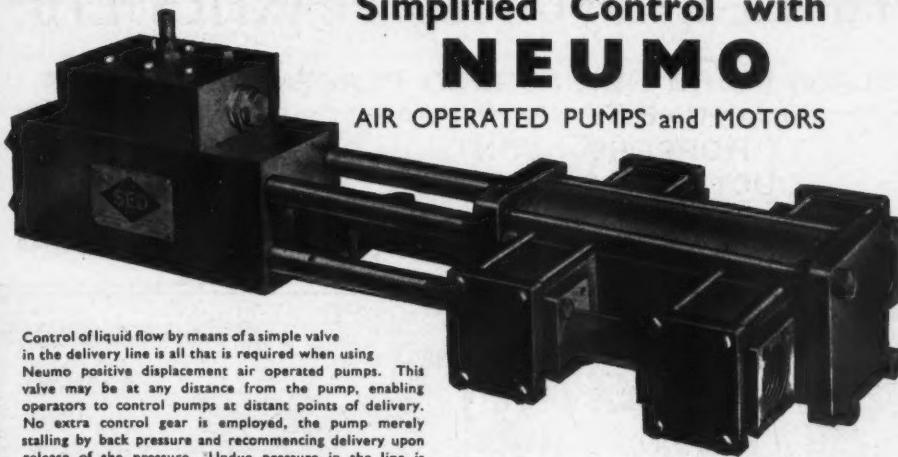
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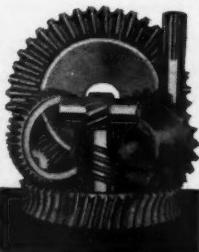
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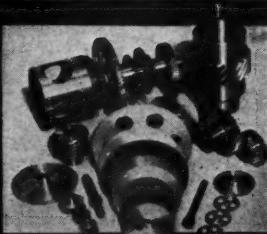


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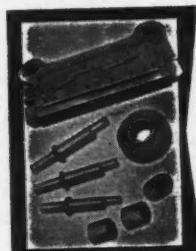
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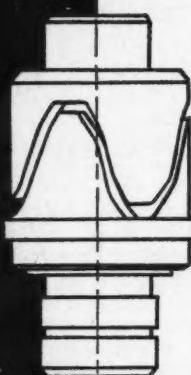
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November 1, 1961

## MACHINERY

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Classified Advertisements (CONTRACT WORK, contd.)



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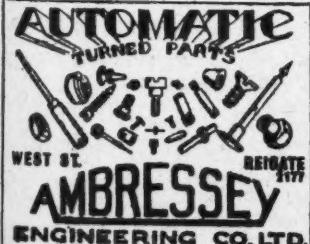
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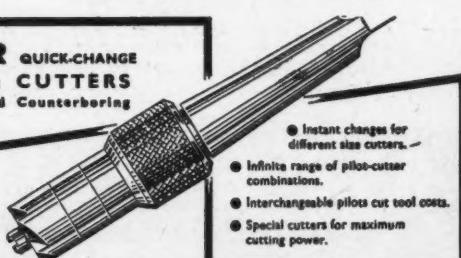
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November 1, 1961

## MACHINERY

Classified Advertisements (PLANT FOR SALE, contd.)

(Suppt.) 157

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**CINCINNATI** Hydromatic 56-72 Hydraulic Plain Horizontal Production Milling Machine. Table 103in. x 26in., speeds 24 to 179 r.p.m.

**CINCINNATI** Model 4HP Heavy Duty Vertical Milling Machine. Table 72in. x 19in., speeds 17 to 480 r.p.m.

**CHURCHILL** Model VB Slideway Grinding Machine, 72in. x 34in. x 36in. Excellent condition.

**KAESER** (Swiss) Hydraulic Plain Cylindrical Grinding Machine. Two machines available. Capacity 6in. x 36in. and 10in. x 20in. Both in excellent condition.

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**PEARL-RICHARDS** PRT2N Horizontal Boring and Facing Machine, 3in. dia. traversing spindle, chain drive to head, 400/3/50.

**REINECKER** Model SSM3 10ft. Heavy Duty External and Internal Spur Gear Shaping Machine. 6in. face width.

**DEMM** Model S 18-750 Gear Shaping Machine.

**ALFRED HERBERT** No. 9a Heavy Duty Combination Turret Lathe, 204in. swing over bed, with taper turning attachment, spindle speeds 11 to 809 r.p.m., covered bed, well equipped.

**WARD** No. 13 Combination Turret Lathe, covered bed, 25in. concentric chuck, 27in. 4-jaw independent chuck. Good turret tooling, taper turning attachment, 35 h.p. motor, 400/3/50. Modern machine. Excellent equipment.

**MITCHELL** 8in. Centres Gap Bed S.S. & S.C. Lathe. Several available. All As New. 52in., 54in. and 64in. between centres.

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**JONES & SHIPMAN** Model 921 Heavy Duty Pillar Drilling and Tapping Machine. No. 5 M.T.

**ORMEROD** 20in. Stroke Pedestal Type Shaping Machine. 9 speeds 9 to 104 s.p.m., 5 h.p. motor. Two machines available.

**KENDALL & GENT** 4ft. x 4ft. x 4ft. Piano Milling Machine. With vertical head, 27 spindle speeds 12 to 700 r.p.m., 9 feeds to table.

**MASSEY** 2-cwt. Pneumatic Power Hammers. 14in. stroke, 200 blows per minute, 10 h.p. motor.

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## MACHINERY

Classified Advertisements (PLANT FOR SALE, cont'd.)

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M/c. 400/3/50 pole-change motor. One spindle No. 2 M.T., 2 spindles No. 3 M.T., geared, auto feed, tapping reverse. Table 37in. x 15in.—**LEE & HUNT LTD.**, Crocus Street, Nottingham. Phone: 84246.

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PAISLEY.

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**KENDALL & GENT** Piano Milling Machine. Two Vert. Heads, 10ft. by 4ft. by 2ft. 9in.

**TURNER BROS.** Power Press T.B.20 20-ton. Rigid geared open fronted. Motorised. 4in. stroke.

**INVICTA** 6M Shaping Machines. 24in. stroke.

**WILKINS & MITCHELL** Power Press. 1,200-ton. Clear space. 10ft. 6in. by 4ft. 6in. Bed 5ft. 6in. daylight. New 1947.

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Hydraulic Universal Grinding Machine, multi motor drive for 400/3/50 volts. Complete with internal grinding attachment, steady, suds pump, tank, etc.—

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10ft. x 6ft. for sale. 210 holes, 1½in. dia. arranged in 35 rows of 6 holes. Between centres 6in. Between row centres 5in. Overall depth 12in. Five ditto, 6ft. x 6ft., with 144 holes, 1½in. dia., arranged in 12 rows of 12 holes. Between row centres 5¼in., between hole centres 5in. Overall depth 8½in.—**F. J. EDWARDS, LIMITED**, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

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Type EP.660 25hp. and switchgear 440v., 3ph., 50cy. Air Receiver and Water-cooling tank. £25.

Foundry equipment, Moulding Machine, Type C.A.1 Jolt, Squeezes and air-oil lift for boxes 20in. x 18in. x 4in. max. £25.

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150 ft. lengths of Conveyor. 14in. x 2in. rollers, 6in. apart. £4 per length.

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All Ex Works.

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can recommend the following modern quality machines from STOCK

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**WICKMAN** 5in. Chucking Automatic. **RYDER** Vertical Auto, capacity 16in. swing x 8in., 6 spindles.

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**KEARNS** O.B. Horizontal Boring Machine, 2½in. Spindle. Spindle speeds 15/600 r.p.m. Excellent condition.

**JONES** 6in. Spindle Horizontal Borer. Table 17ft. 6in. x 8ft. Spindle travel 48in. Rapid traverse 84in. per min. Motorised 400/3/50. Weight 70 tons.

**BULLARD** 36in. Vertical Boring Mill.

**KITCHEN & WADE** Vertical Fine Boring Machine, 14in. stroke. Compound table.

## DRILLING MACHINE

**ARCHDALE** 8-Spindle Hydraulic Vertical Drilling Machine.

## GRINDING MACHINES

**LANDIS** Universal Cylindrical Grinder, 12in. x 36in.

**BROWN & SHARPE** No. 5 Surface Grinder, 10in. throat.

**BROWN & SHARPE** No. 2 Surface Grinder, 18in. x 6in. table.

**KELLER** No. R6 Tool and Cutter Grinder.

**HEALD** No. 172 Gap Bed Internal Grinding Machine, maximum diameter of component 36in.

## LATHES

N.D. 8in. x 6ft. S.S. & S.C. Lathe, 30in. between centres.

**NOBLE & LUND** Heavy Duty Centre Lathe, 22in. centre height x 29ft. between centres. Max. swing over saddle 33in. dia.

**HARVEY** Heavy Duty Centre Lathe, 42in. centre height x 52in. between centres. Max. swing over saddle 5in. dia.

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**EDGWICK** No. 2 Universal Milling Machine. Working surface of table 38in. x 74in.

**BROWN & SHARPE** No. 3A Universal Milling Machine with Vertical Head Attachment. Spindle speeds 30/1,200. Power feed all movements.

**COLLET & ENGLEHARDT** Keller Type Collet Sinking Machine. Model FK80 capacity 60in. x 30in.

## PLANING MACHINES

**CLEVELAND** Open-side Planing Machine, capacity 10ft. x 2ft. 6in.

**CINCINNATI** Planing Machine, capacity 8ft. x 2ft. 6in.

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Hydraulic Vertical Internal Honing Machine (manufactured by **PETER WOLTER**). Capacity 0.2in. to 2in.

**RAPIDAN** Double Helical Gear Generating Machine, 12in. diameter capacity.

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Unused KITCHEN & WADE 3ft. Type E.26 Radial Drilling Machine, with loose box table, electric switch and fittings.

KITCHEN & WADE 6ft. Girder Type Radial Drilling Machine, 18 spindle speeds, 6 feeds, No. 5 M.T. spindle.

**BORING MACHINES**

ASQUITH Floor Type Horizontal Borer, 8in. diameter travelling spindle, swivelling column with 6ft. x 5ft. tee-slootted bedplate.

**SLOTTING MACHINE**

ORMEROD 12in. stroke Slotted Machine, 27in. dia. rotary table.

**LATHES**

LANG 20in. swing Surfacing and Boring Lathe, with hexagon turret, to admit 10ft. between centres.

SWIFT 8in. S.S. & S.C. Gap Bed Lathe, to admit 8ft. 6in. between centres.

EDGWICK 6in. S.S. & S.C. Gap Bed Lathe, to admit 5ft. 5in. between centres.

COLCHESTER 8in. Mascot S.S. & S.C. Gap Bed Lathes, to admit 6ft. 6in. between centres.

GRAVEN 15in. S.S. & S.C. Lathes, to admit 10ft. between centres.

**MILLING MACHINES**

CINCINNATI Model 1/18in. Production Milling Machine, table 35in. x 10in., with automatic feed cycle.

ST. ANDREWS Horizontal type Heavy Duty Plain Milling Machine, table size 73in. x 16in.

HERBERT 46V Vertical Milling Machine, working surface of table 58in. x 15in., power feed to table in all directions, longitudinal traverse 36in., motorised 400/3/50 supply.

G.V.A. "Kearney & Trecker" model 2E Dia. Type Horizontal Plain Drilling Machine, working surface of table 41in. x 12in., longitudinal feed 29in., cross feed 12in., 8 spindle speeds 25/1,000 r.p.m.

CINCINNATI 16in. x 36in. Hydromatic Milling Machine, table 54in. x 14in.

**BROACHING MACHINE**

CINCINNATI 10 ton Vert. Single Ram Hydraulic Surface Broaching Machine, 66in. stroke 20in. x 20in. table.

**GRINDING MACHINES**

LANDIS 10in. x 24in. Universal Grinding Machine, with hydraulic feed and internal grinding attachment.

MORTON 18in. x 16in. Hydraulic Horizontal Surface Surface Grinding Machine.

JONES & SHIPMAN Fig. 540 18in. x 6in. Hydraulic Horizontal Spindle Surface Grinding Machine, with 14in. x 6in. magnetic chuck.

CHURCHILL 16in. x 36in. Model PRE Universal Grinding Machine, with hydraulic feed and internal grinding attachment.

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H.M.E. 100 ton Gated Rigid Power Press, with adjustable stroke 1in. to 6in.

New HERBERT 16in. x 20 Ton Ungeared Power Press, 1in.-3in. adjustable stroke.

**PUNCHING AND SHEARING MACHINE**

BENNIES Universal Combined Punching, Shearing and Cropping Machine, to shear 1in. plate, punch 1in. through 1in., crop 4in. x 4in. x 1in. angles.

**SAWING MACHINE**

NOBLE & LUND 30/38in. Cold Circular Sawing Machine, with 40in. table, 14in. diameter rounds, 1in. square 24in. x 7in. beams.

**SCREWING MACHINE**

KENDALL & GENT 3-2 Tangential Head Screwing Machine, to screw bolts up to 2in. outside diameter, tubes up to 3in. inside diameter, machine fitted with leadscREW.

**SHAPING MACHINES**

HERBERT 20in. stroke Shaping Machine, 6 ram speeds.

ORMEROD 18in. stroke Shaping Machine, 9 ram speeds.

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CLYDE 10 ton Overhead Electric Travelling Crane, 55ft. 5in. span.

All the above machines are motorised 400-440/3/50 cycles.

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Classified Advertisements (PLANT FOR SALE, contd.)

**10in. x 24in. Churchill Model**

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**Bryant No. 24-36 Hydraulic**

Internal Grinder, complete with Hydraulic Wheel Dressing device, Spindle, etc.

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**F.J. Edwards Ltd**

No. 12 BYDERMATIC three slide Vertical Multi-tool Lathe, maximum swing 20in., maximum length 16in., vertical slide stroke 5in. horizontal slide stroke 5in.

HERBERT No. 6 Auto Clutch Lathe, swing 18in. over bed. 3in. hollow spindle.

**SHAPING MACHINES**

NEW 10in. Shapers.

GOULD & EBERRHARDT 20in. Shaper.

MUTLER 12in. and 18in. Shapers.

ALBA 24in., 18in., 14in. and 10in. Shapers.

ORMEROD 26in. stroke Traversing Head Shaping Machine, with two universal box tables. 1955 machine.

**SLOTTING MACHINES**

BETTS 12in. stroke heavy duty Slotting Machine. New 7in. stroke Toolroom Slotters.

**TAPPING MACHINES**

JONES & SHIPMAN "Electrotap" Vertical Tapping Machine, leadscrew control with auto cycle for depth, reverse and stop. 1in. stroke 200 r.p.m.

HERBERT 4in. No. 1 Flametapper.

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BULLARD 30in. Vertical Boring Mills, with side head, integrated.

EMTAC Jig Boring Machine, table 27in. x 11in.: spindle No. 2 Morse taper, 350 to 3,500 r.p.m.

WEBSTER & BENNETT 36in. Vertical Boring Mill with Murray colour control, 6.5 to 124 r.p.m.

GIDDINGS & LEWIS No. 0 Horizontal Boring Milling and Drilling Machine, spindle 3in. dia.

KEARNS Size OB Horizontal Boring Machine, covered bed, screw cutting motion, 2in. traversing spindle.

PADDON Vertical Cylinder Borer for automobile cylinders, 2.2in. to 5.5in. dia.; boring depth 14in.

**DRILLING MACHINES**

NEW 3ft. Radial Drilling Machines, No. 4 Morse Taper, swivel table, 500 r.p.m.

AMERICAN TOOLWORKS 3ft. 6in. Radial Drilling Machine, No. 4 Morse Taper; speeds 93-2,000.

NEWDOWN 4ft. 6in. model AE4 Elevating Arm Radial Drilling Machine, No. 5 Morse Taper.

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LELAND-GIFFORD 3-spindle Drilling Machine on 4-spindle base, with 4-speed direct mounted motors, No. 3 Morse Taper.

JONES & SHIPMAN 1in. 4-spindle Drilling Machine, separate pole change motors.

ATKINSON and POLLARD No. 3, 4 and 5. Morse Taper Production Drilling Machines. New Heavy Duty Production Drilling Machines. No. 5 Morse Taper; hydraulic feed to spindle and table.

HERBERT Type C Pedestal Drilling Machine. 3 Morse Taper, 230 volts, single phase. Auto spindle feed; flange mounted motor.

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BARBER-COLMAN 12in. Gear Hobber.

FELLOWS No. 645A3 Gear Shaper, capacity 18in. x 8in.

FELLOWS No. 6 and 612 Gear Shapers; 35in. x 5in. capacity.

FELLOWS No. 61A Gear Shaper, 18in. x 5in. capacity.

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CINCINNATI 12in. x 48in. Universal Grinder.

NEW 3in. x 14in. Universal Grinders.

MATRIX 1A Universal Grinder, 9in. x 24in.

CHURCHILL 12in. x 36in. Hydraulic Universal Grinder.

CHURCHILL 16in. x 50in. Universal Tool and Cutter Grinder.

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LUMEDEN 18in. x 6in. Horizontal Surface Grinder.

339-341, EUSTON RD., LONDON, N.W.1.

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**BROWN & SHARPE** No. 2 Universal Milling Machine. Table 46in. by 10in. With Vertical Milling Attachment, Slotting Attachment, Universal Dividing Head, chuck, rotary table, and other equipment.

**ARCHDALE** 28in. Plain Horizontal Milling Machine, prismatic over-arm, power feed and rapid traverses. Table 49in. by 13in. With arbor, two arbor supports, arm brace, self-contained electric suds pump.

**ARCHDALE** 20in. Plain Horizontal Milling Machine. Table 41in. by 10in. Dial type feed and speed change. With arbor and arbor support, arm brace, separate electric suds pump and tank.

**EDGWICK** 18in. Plain Horizontal Milling Machine. Table W.S. 26in. by 7in.

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**CHURCHILL** Horizontal Spindle Surface Grinder. Table W.S. 13in. by 36in.

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**CHURCHILL** Model "O" Universal Tool and Cutter Grinder. Capacity 8in. by 16in.

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**PFAUTER** R.S. 11 Horizontal Gear Hobbing Machine.

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**WARD** No. 2A Capstan Lathe, with power feed to saddle.

**WARD** No. 3A Capstan Lathe, with ball chuck and bar feed.

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**JONES & LAMSON** Turret Lathe. 2in. Hollow Spindle. With 4 jaw chuck.

**DRUMMOND** Model K Capstan Lathe. 2½in. Hollow spindle. Chucking.

**HERBERT** No. 2B Capstan Lathe, chucking.

**HERBERT** No. 1S Capstan Lathe, chucking. TWO MOREY No. 2G Capstan Lathes, chucking 1in. capacity.

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**DEAN, SMITH & GRACE** A.N. type 7in. by 4ft. between centres, S.S. & S.C. Gap Bed Lathe. 2in. Hollow spindle. Swing in gap 24½in. by 7½in. With chucks, etc.

**CARSTENS** 4½in. by 20in. between centres S.S. and S.C. High speed Precision Lathe, fully equipped collets, chucks, etc.

**CHURCHILL** CUB 5in. by 20in. between centres S.S. & S.C. Lathe, with chucks, pick-off gears.

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**ALBA** 18in. Crank Shaping Machine.

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**JONES & SHIPMAN** Electrotap, with quantity of leaders.

**SIX TURNER** Spin Riveting Machines, type R.S.S., air operated.

**CANNING** Centreless Polishing Machine, with motorised dust extractor.

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All machines self-contained drive. 400/440 volts, 3 phase, 50 cycles unless otherwise stated.

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**1954 MACHINE  
IN FIRST CLASS  
CONDITION.**

Spindle Diameter 4in., No. 6 Morse Taper.  
Speeds = 18, from 8.5 to 1680 r.p.m.  
Facing Head 24in. dia., with Facing Capacity up to 43 $\frac{1}{4}$ in. dia.  
Facing Head Speeds = 9 from 8.5 to 335 r.p.m.  
Main Table 7in. by 47in.  
12 Feeds per Spindle Revolution = .0012in. to .2in.  
6 Feeds per Facing Head Revolution = .003in. to .1in.  
Power Feeds and Rapid Traverse in all Directions.  
Illuminated Vernier Readings in all Directions.  
English Calibrations.  
Extended Bed and Heightened Column.

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WELSH HARP, EDGWARE ROAD, LONDON, N.W.2

GLADSTONE 0033

**HERBERT 9A** Combination Turret Lathe. Swing over bed 20 $\frac{1}{2}$ in. Hole through spindle 4 $\frac{1}{2}$ in. 16 spindle speeds 21-809. Motorised 400/3/50.

**HERBERT 8in.** by 6ft. Oin. N.D. Lathe. Vee Bed. 1 $\frac{1}{2}$ in. hollow spindle. Norton type gearbox. Motorised.

**RYDERMATIC** Verticalauto. Capacity 18in. by 9in. 6-spindles. Tool Slides 22in.

**WILKINS & MITCHELL** Power Press. 1,200-ton. Clear space. 10ft. 6in. by 4ft. 6in. Bed. 5ft. 6in. daylight. New 1947.

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**New Horoma Junior J3, High Speed Tube Cutting Machine for sale.** Capacity tubes from 1in. to 2in. diameter, max. wall thickness in steel  $\frac{1}{8}$ in. in non-ferrous material 1in. Solid disc cutter which operates at the rate of 1,500-2,000 pieces per hour without swarf or waste. Motor driven 400-440/3/50.—F. J. EDWARDS LIMITED, 359, Euston Road, London, N.W.1, or 41, Water Street, Birmingham 3.

**Kearns No. 1 Horizontal Boring and Facing Machine**, complete with Rear Stay, A.C. Motor.

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**8in. Centre "Reed-Prentice"** m/d all-gearred S.S. & S.C. Lathe. Admits 4ft. 6in. b.c., 16 speeds 18-536 r.p.m. Spindle bearing 1 $\frac{1}{2}$ in. dia. mounted in Timken roller bearing. Norton type gearbox.—LEE & HUNT, LTD., Crocus Street, Nottingham. Phone: 84246.



**SCHIESS 5in. HORIZONTAL BORING MACHINE**

Table Type HB13

Main Data:—

Dia. spindle.....	5in.
Spindle travel.....	43 $\frac{1}{2}$ in.
12 spindle speeds.....	3-175 r.p.m.
Dia. face plate.....	26in.
Working surface table.....	63in. x 55in.
Facing capacity.....	47in.
Distance spindle to stay.....	11ft. 6in.
H.P. motor.....	15

Completely overhauled and ready for work. Can be seen working.

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**MYFORD MG.12 Grinders,**  
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**COLCHESTER**, Chipmaster, Student and Triumph Lathes.

**SMART & BROWN** 'A', 1024' Lathes, Toggle Presses and Screwing Machines.

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Showrooms at: 342 QUEENSTOWN ROAD (Close to Chelsea Bridge) and CRANFORD LANE, HOUNSLOW (Close to London Airport)

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- CONOMATIC (U.S.A. Built) 4 Sp. 4½in. Cap.
- GREENLEE 6 Sp. 1½in. Cap.
- CONOMATIC 6 Sp. 1½in. Cap.
- B.S.A. GRIDLEY 4 Sp. ½in. Cap.
- GRIDLEY 6 Sp. ½in. Cap. (choice of two).
- HERBERT No. 4 Chucking.

## BORERS

- Horizontal
- PEARL RICHARDS No. 3.
- RICHARDS H8. 2A 3in. Travelling Spindle (choice of three).
- KEARNS OC. 2½in. Travelling Spindle (choice of three).

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- CRAVEN 36in. heavy duty, side head, elevating cross rail, rapid feeds.

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- CHURCHILL 20in. by 96in. Hyd. Cylindrical. S/N20468
- LANDIS 6in. by 18in. Plain Cylindrical (1952)
- CHURCHILL 16in. by 72in. Universal.
- CHURCHILL 12in. by 50in. Hyd. Universal, internal spindle.
- FITCHBURG 12in. by 32in. Universal.
- JONES SHIPMAN 8in. by 16in. Universal, internal spindle.
- LUMSDEN 24in. dia. Retractable Rotary Table Surface Model 90RT. With Chuck (1952)
- ORCUTT 20in. Spindle.

## GEAR MACHINERY

- GLEASON No. 24 Straight Bevel Generator S/N17920
- GLEASON 12in. Single Roll. Roughing and Finishing. S/N20129.
- MICHIGAN Gear Lapper. S/N2280.

## DRILLS

- Radial
- ARDHALE 4ft.; 60 to 1,500 r.p.m. (choice of four).
- ASQUITH 4ft. 6in.; 31 to 850 r.p.m. (choice of two).
- KITCHEN & WADE 4ft. Bridge Type.
- Single Spindle
- ASQUITH 2in. Cap.; 31/850 r.p.m. Column (choice of two). 1952

## Multi Spindle

- BARNESDRILL 16 Sp. ½in. Cap.
- ARCHADE 12 Sp. ½in. Cap. F. Cluster

## LATHES

### Centre

- SWIFT 13in. by 132in.; 3.6 to 220 r.p.m. Straight Bed.
- SPRINGFIELD 12in. by 48in.; 9 to 380 r.p.m. Straight Bed.
- SCULFORT 12in. by 70in.; 12.5 to 1,000 r.p.m.
- DEAN, SMITH & GRACE 12in. by 66in., 19 to 418 r.p.m. Straight Bed.
- PROGRESSIVE 11in. by 120in.; 20 to 516 r.p.m. Gap Bed.
- SWIFT 10½in. by 96in.; 11 to 400 r.p.m. Straight Bed.
- MONARCH 20in. swing 96in. B.C. 12 to 487 r.p.m. Straight Bed.
- DEAN, SMITH & GRACE 8½in. by 50in.; 11 to 490 r.p.m. Straight Bed.
- DEMOOR 8in. by 42in.; 25-1250. Gap Bed.
- HOLBROOK 8½in. by 42in.; Straight Bed (choice of two).
- PROGRESS 8in. by 60in.; 23 to 1,050 r.p.m. Gap Bed.

### Capstan, Comb. Turret

- LIBBY 2H Comb. Hole in spindle 8½in., 5/165 r.p.m.
- LIBBY 1H5 Comb. Hole in spindle 5½in. Power and rapid feeds to Saddle, Turret and Cross slide.
- GISHOLT 2L Comb. 22in. swing. 1952 built
- WARD 10B Comb. Power feed to Turret, Air Ball Chuck, Bar Feed Equipment Rebuilt.

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- MILWAUKEE 2K, 15 to 1,500 r.p.m. (choice of two)
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- CINCINNATI 08, table 18½in. by 6½in.; 75 to 1,100 r.p.m. Production (choice of two).

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Ref. 16072/61/EMB/HAL.3

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The application for tenders should clearly state the above reference number.

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Description  
Q'ty.  
Nos.

DIE-CASTING MACHINES for use  
with Brass and Masak Alloy 2

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Only the manufacturers (including their contractors or Associates authorized to commit them) or their accredited Agents who are in a position to supply the requirements from their own or their Principal's manufacturers are invited to quote.

Please quote Reference No. 2086 } 61/ENG.3,  
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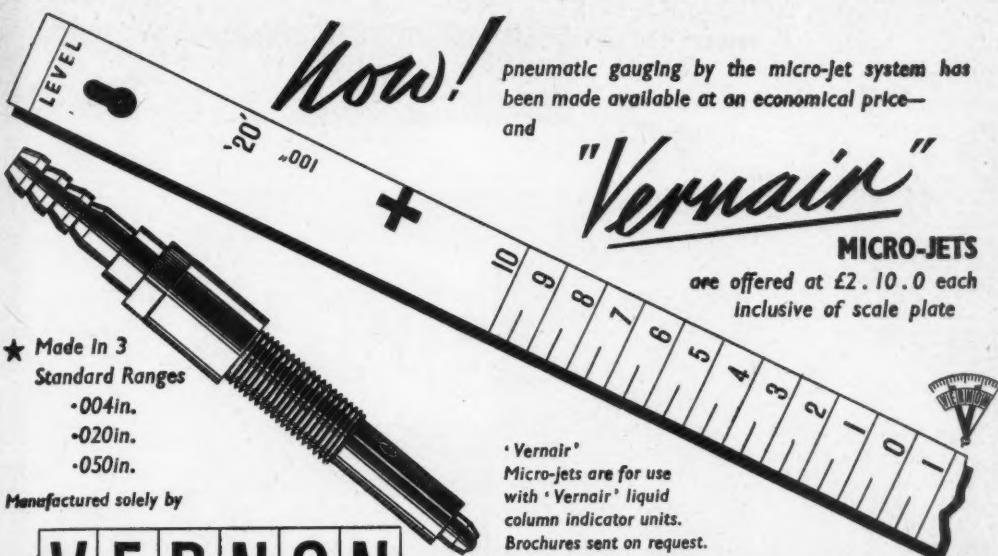
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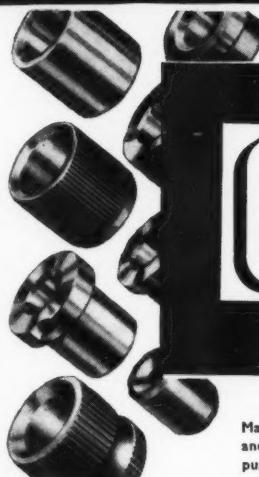
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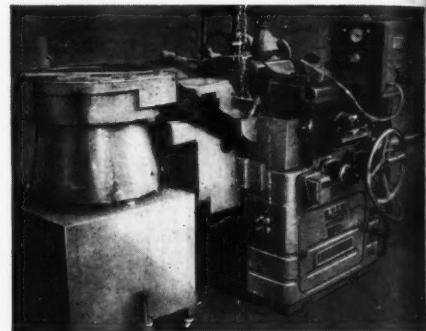
**Control wheel Speeds : 4**

**Width of wheels.** 4" (101 mm) or

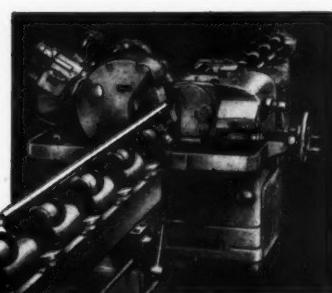
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